Du'Bois J. Ferguson
Remediation Manager

Schlumberger Oilfield Service
300 Schlumberger Drive
Sugar Land, TX 77478
Tel: 281-285-3692
DFerguson3@slb.com

April 10, 2010

VIA FedEx Overnight

Section Chief
Environmental Enforcement Section
U.S. Department of Justice
PO Box 7611
Washington, DC 20044-7611

Craig Zeller
Remedial Project Manager
Superfund Division
U.S. EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303

Re: DOJ Case No. 90-11-2-696/1

Subject: March 2010 Monthly Report
Sangamo Weston/Twelvemile Creek/Lake Hartwell Superfund Site
Natural Resources Trustees Consent Decree

Dear Section Chief:

In accordance with the Consent Decree and Section XIV of the Unilateral Administrative Order for the above referenced site, Schlumberger is required to submit Progress Reports on a quarterly basis. Given the current pace of activities, we will be submitting Progress Reports on a monthly basis until further notice in satisfaction of the reporting requirements of the Consent Decree and Unilateral Administrative Order.

In keeping with Paragraph 20 of the Consent Decree:

> I certify that the information contained in or accompanying this submission is true, accurate and complete. This certification is based on my personal preparation, review, or analysis of the submission, and/or supervision of persons who, acting on my instructions, made the verification that the submitted information is true, accurate and complete.

If you have any questions, please do not hesitate to contact me at (281) 285-3692.

Sincerely,

D. J. Ferguson

DuBois J. Ferguson
Remediation Manager

U.S. EPA REGION IV

SDMS

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V. 2-040506

cc: Honorable G. Ross Anderson, Jr.
G. Ross Anderson, Jr. Federal Building
and United States Courthouse
315 South McDuffie Street, 2nd Floor
Anderson, SC 29624

Honorable William W. Wilkins
Nexsen Pruet
55 E. Camperdown Way
Suite 400
Greenville SC 29601

Leon C. Harmon Esq.
Nexsen Pruet
55 E. Camperdown Way
Suite 400
Greenville SC 29601

John Cresswell
Assistant Director
Division of Site Assessment and Remediation
Bureau of Land &Waste Management
SC Department of Health and
Environmental Control
2600 Bull Street
Columbia, SC 29201

Regional Solicitor's Office
U.S. Department of the Interior
Attn: Harriet M. Deal
75 Spring Street, SW Room 304
Atlanta, GA 30303

Diane Beeman
Ecological Services Office
U.S. Fish and Wildlife Service
176 Croghan Spur Road, Suite 200
Charleston, SC 29407

Paul League
SC Department of Natural Resources
Office of Chief Counsel
1000 Assembly Street
Columbia, SC 29202

Anthony Rabern
Georgia Department of Natural Resources
3695 Highway 197

Clarkesville, GA 30523

Office of the Attorney General
Timothy J. Ritzka
Assistant Attorney General
40 Capitol Square SW
Atlanta, GA 30334

Jamie Sykes
Richard B. Russell Project Office
4144 Russell Dam Drive
Elberton, GA 30635

Frank S. Holleman III
Wyche Burgess Freeman & Parham, P.A.
44 East Camperdown Way
Greenville SC 29601-3591

Mr. Paul Doody
ARCADIS
6723 Towpath Road
Syracuse, NY 13214-0066

Mr. John N. Hanson
Beveridge & Diamond, P.C.
1350 I Street, N.W.
Suite 700
Washington, D.C. 20005-3311

March 2010 Monthly Report
Sangamo Weston/Twelvemile Creek/Lake Hartwell Superfund Site
Operable Unit 2

Activities Completed

- Completed earthwork related to the Sediment Management Unit (SMU) area.
- Continued installation of the dredge materials handling equipment and water treatment components, including completion of installation of the water treatment system and automated water sampling equipment on the effluent discharge.
- Completed resurfacing of Old Henderson Road.
- Continued construction of HDPE dredge piping.
- Completed initial installation of the Modutank system.
- Installed turbidity monitors at three locations in Twelvemile Creek for monitoring dredging operations in Twelvemile Creek, and initiated sampling and analysis program for creek turbidity and water treatment system effluent water.
- Initiated sediment dredging startup and shakedown activities in Twelvemile Creek adjacent to and downstream of Ball's Beach and at Woodside Dam I (WS1) impoundment.
- Initiated placement of 24" protective cover material within the SMU.
- On March 3, 2010, John McCain and John Schnabel conducted a visit to the SMU site to inspect the SMU liner.
- On March 5, 2010, Eric Kim and Susan Turner (both from SCDHEC) conducted a visit to the SMU site to inspect the water treatment system (WTS).
- On March 13, 2010, Weston, Orion, Envirocon, Schlumberger, and ARCADIS conducted a pre-dredge meeting, and Clean Harbors, Weston, and ARCADIS conducted a meeting to discuss the WTS and schedule.
- On March 18, 2010, two visitors from SCDHEC (Bill Williamson and John Cobb) were on-site to assess the WTS and the effect of the Modutank failure.
- On March 24, 2010, five visitors from SCDHEC (Greg Cassidy, James West, Carrie Turner, Kayse Jarman, and Chuck Williams) conducted a visit to the SMU site for a tour.
- On March 30. A meeting was conducted with Leon Harmon, John Adams, and Keith Knight to discuss the dredge verification protocols.
- On March 31, 2010, Weston, Envirocon, Schlumberger, and ARCADIS conducted a meeting to review progress and chart future work activities.
- Installed erosion and sediment controls at the SMU site and continued to maintain permanent and temporary ponds, a double row of silt fence around the entire site, waddles, hay bales, check dams and retention structures.

Results of Sampling, Tests, and Other Data

- Collected pre-dredge bedrock and sediment survey data in Twelvemile Creek. Tabular results are attached (Attachment 1).
- Performed pressure testing on WTS piping per SCDHEC requirements. Testing results are attached (Attachment 2).
- Sampling and analysis is being conducted relative to the creek turbidity, and water treatment system effluent water. Results are available onsite.

Plans, Reports, and other Deliverables

- Several deliverables related to the substantive regulatory requirements for the work were submitted to SCDHEC and Pickens County last month. Final versions are attached.
- An approval letter was received from SCDHEC dated March 11, 2010 (attached) that addressed the following documents:
    - Groundwater Monitoring Plan
    - Water Treatment Monitoring Plan
    - Closure/Post-Closure Operating and Maintenance Plan
    - Fill Progression Plan
- An approval letter was received from Pickens County dated February 23, 2010 (attached) that addressed the following document:
    - Addendum to the site Stormwater Pollution Prevention Plan (SWPPP).
- The Revised Dredge Verification Plan was submitted to the Trustees on March 11, 2010. Pete Stevens' verbal approval was received from Pete Stevens on March 13, 2010.

Work Planned for April 2010

- Continue management of storm water BMPs.
- Continue sediment dredging activities downstream of Ball's Beach and at WSI impoundment.
- Continue placement of 24" protective cover/dredge material in SMU.
- Install ModuTank double layer liner system.

Problems Encountered, Anticipated Delays, Solutions

- Fluid losses from the ModuTank due to a compromised liner system were observed on March 18, 2010. A double liner system with a leak detention system

has been installed, following review approval by SCDHEC. Lab testing on released fluids did not indicate any trace of contaminants.

ARCADIS

Attachment 1

Attachment 1
Pre-Dredge Bedrock and Sediment Survey Results

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

Collection dates: 02/15/2010 thru 02/17/10

Shot Number	Northing	Easting	Elevation(T/Sed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
670	1073725.18	1465407.01	722.38	sta 26 0+00 tob	722.38	0.00	0	Bedrock
671	1073728.67	1465405.05	719.09	sta 26 0+05 eow	719.09	0.00	0	Bedrock
672	1073737.96	1465396.09	715.71	sta 26 0+10	714.71	6.80	1	Sand over Bedrock
673	1073750.39	1465384.44	715.48	sta 26 0+20	711.26	3.70	4.2	Sand over Bedrock
674	1073754.58	1465381.75	716.58	sta 26 0+30	711.18	2.80	5.4	Sand over Bedrock
675	1073762.17	1465377.74	717.35	sta 26 0+40	711.65	1.80	5.7	Sand over Bedrock
676	1073774.12	1465371.46	717.28	sta 26 0+50	715.88	1.80	1.4	Sand over Bedrock
677	1073789.65	1465370.84	719.23	sta 26 0+60 eow	714.23	0.00	5	Sand over Bedrock
678	1073801.29	1465366.54	722.36	sta 26+75 tob	714.36	0.00	8	Sand over Bedrock
679	1073695.86	1465304.92	719.27	sta 27 0+00 tob	719.27	0.00	0	Bedrock
680	1073705.96	1465300.71	715.19	sta 27 0+10 eow	715.19	4.00	0	Bedrock
681	1073717.50	1465292.57	713.66	sta 27 0+20	712.26	5.40	1.4	Sand over Bedrock
682	1073733.53	1465281.23	716.09	sta 27 0+30	710.89	3.10	5.2	Sand over Bedrock
683	1073749.50	1465287.22	717.45	sta 27 0+40	712.05	1.60	5.4	Sand over Bedrock
684	1073762.81	1465291.66	718.58	sta 27 0+50	714.08	0.50	4.5	Sand over Bedrock
685	1073771.59	1465290.82	719.12	sta 27 0+65 eow	715.12	0.00	4	Sand over Bedrock
686	1073790.81	1465289.49	723.24	sta 27 0+65 tob	716.44	0.00	6.8	Sand over Bedrock
687	1073713.83	1465183.47	720.56	sta 28 0+00 tob	720.56	0.00	0	Bedrock
688	1073718.70	1465183.89	719.17	sta 28 0+02 EOW	719.17	0.00	0	Bedrock
689	1073723.84	1465177.78	715.47	sta 28 0+10	712.97	3.80	2.5	Sand over Bedrock
690	1073736.64	1465176.95	716.40	sta 28 0+20	711.90	2.80	4.5	Sand over Bedrock
691	1073747.02	1465176.09	716.02	sta 28 0+30	712.52	2.80	3.5	Sand over Bedrock
692	1073757.10	1465175.80	716.01	sta 28 0+40	713.01	3.10	3	Sand over Bedrock
693	1073773.43	1465180.59	717.33	sta 28 0+50	714.43	2.20	2.9	Sand over Bedrock
694	1073787.88	1465184.83	719.03	sta 28 0+60 EOW	714.03	0.00	5	Sand over Bedrock
695	1073800.18	1465185.96	724.79	sta 28 0+70 tob	717.79	0.00	7	Sand over Bedrock
696	1073699.15	1465090.80	721.20	sta 29 0+00 tob	718.20	0.00	3	Sand over Bedrock
697	1073702.30	1465086.78	719.16	sta 29 0+05 ew	717.16	0.00	2	Sand over Bedrock
698	1073712.58	1465085.89	718.07	sta 29 0+10	712.97	1.10	5.1	Sand over Bedrock
699	1073724.58	1465087.30	717.33	sta 29 0+20	712.13	1.80	5.2	Sand over Bedrock
700	1073748.38	1465081.73	716.82	sta 29 0+30	712.62	2.20	4.3	Sand over Bedrock
701	1073759.29	1465081.45	716.56	sta 29 0+40	713.76	2.50	2.8	Sand over Bedrock
702	1073774.03	1465082.61	716.00	sta 29 0+50	713.70	3.10	2.3	Sand over Bedrock
703	1073794.38	1465082.65	719.32	sta 29 0+65 eow	713.42	0.00	5.9	Sand over Bedrock
704	1073806.15	1465081.79	724.07	sta 29 0+75 tob	714.87	0.00	9.2	Sand over Bedrock
706	1073680.30	1464982.77	722.88	sta 30 0+00 tob	713.88	0.00	9	Sand over Bedrock
707	1073793.93	1464982.73	718.87	sta 30 0+07 eow	709.87	0.00	9	Sand over Bedrock
708	1073780.81	1464979.95	715.38	sta 30 0+20	710.88	3.50	4.5	Sand over Bedrock
709	1073770.77	1464979.59	715.32	sta 30 0+30	710.82	3.50	4.5	Sand over Bedrock
710	1073761.29	1464980.03	716.19	sta 30 0+40	711.89	2.70	4.3	Sand over Bedrock
711	1073742.21	1464982.59	717.92	sta 30 0+50	711.62	0.80	6.3	Sand over Bedrock
712	1073718.03	1464988.21	718.06	sta 30 0+60	713.36	0.80	4.7	Sand over Bedrock
713	1073697.79	1464991.66	718.62	sta 30 0+65 eow	713.62	0.00	5	Sand over Bedrock
714	1073690.14	1464995.02	723.74	sta 30 0+75 tob	721.24	0.00	2.5	Sand over Bedrock
715	1073681.53	1464901.72	724.15	sta 31 0+00 tob	713.65	0.00	10.5	Sand over Bedrock
716	1073690.22	1464901.30	718.81	sta 31 0+10 eow	709.81	0.00	9	Sand over Bedrock
717	1073707.61	1464896.86	718.07	sta 31 0+20	710.67	0.90	7.4	Fine sands over Bedrock
718	1073724.88	1464894.60	717.11	sta 31 0+30	710.41	1.70	6.7	Fine sands over Bedrock
719	1073741.57	1464891.57	716.73	sta 31 0+40	709.13	2.20	7.6	Fine sands over Bedrock
720	1073755.78	1464889.43	716.20	sta 31 0+50	708.40	2.70	7.8	Fine sands over Bedrock
721	1073786.44	1464887.30	715.92	sta 31 0+70 eow	715.72	3.00	0.2	Fine sands over Bedrock
722	1073800.78	1464891.08	724.56	sta 31 0+80 tob	718.96	0.00	5.6	Fine sands over Bedrock
723	1073772.19	1464758.06	724.01	sta 32 0+00 tob	715.81	0.00	8.2	Fine sands over Bedrock
724	1073764.80	1464757.33	718.56	sta 32 0+08 eow	710.76	0.00	7.8	Fine sands over Bedrock
725	1073742.13	1464761.44	716.82	sta 32 0+15	708.82	1.90	8	Fine sands over Bedrock
726	1073729.61	1464763.32	716.82	sta 32 0+25	709.42	1.90	7.4	Fine sands over Bedrock
727	1073704.15	1464767.71	716.66	sta 32 0+35	708.06	2.10	8.6	Fine sands over Bedrock
728	1073695.68	1464770.58	716.52	sta 32 0+45	712.32	2.30	4.2	Fine sands over Bedrock
729	1073678.06	1464776.92	716.00	sta 32 0+55	712.70	0.70	5.3	Fine sands over Bedrock
730	1073657.26	1464784.05	718.84	sta 32 0+65 eow	711.44	0.00	7.4	Fine sands over Bedrock
731	1073649.79	1464788.56	724.46	sta 32 0+75 tob	716.26	0.00	8.2	Fine sands over Bedrock
732	1073634.96	1464678.14	724.66	sta 33 0+00 tob	713.06	0.00	11.6	Fine sands over Bedrock
733	1073643.58	1464674.04	718.69	sta 33 0+10 eow	715.89	0.00	2.8	Fine sands over Bedrock
734	1073657.29	1464677.21	716.90	sta 33 0+20	711.10	1.70	5.8	Fine sands over Bedrock
735	1073674.65	1464675.22	716.32	sta 33 0+30	709.72	2.40	6.6	Fine sands over Bedrock
736	1073694.86	1464675.25	716.50	sta 33 0+40	709.00	2.00	7.5	Fine sands over Bedrock
737	1073718.93	1464674.64	715.73	sta 33 0+50	709.23	2.90	6.5	Fine sands over Bedrock
738	1073741.35	1464669.16	718.32	sta 33 0+65 eow	714.62	0.30	3.7	Fine sands over Bedrock
739	1073753.22	1464675.50	724.56	sta 33 0+75 tob	718.66	0.00	5.9	Fine sands over Bedrock

740	1073608.19	1464567.44	724.78	sta 34 0+00 tob	709.78	0.00	15	Fine sands over Bedrock
741	1073617.78	1464567.74	719.24	sta 34 0+10 eow	709.74	0.00	9.5	Fine sands over Bedrock
742	1073633.95	1464561.44	715.41	sta 34 0+20	708.11	3.20	7.3	Fine sands over Bedrock
743	1073650.53	1464555.37	716.45	sta 34 0+30	708.75	2.10	7.7	Fine sands over Bedrock
744	1073659.98	1464570.64	716.90	sta 34 0+40	708.10	1.70	8.8	Fine sands over Silt; Refusal
745	1073678.60	1464569.69	716.81	sta 34 0+50	707.61	1.80	9.2	Fine sands over Bedrock
746	1073697.54	1464568.86	716.53	sta 34 0+60	707.23	2.20	9.3	Fine sands over Bedrock
747	1073709.24	1464566.93	717.47	sta 34 0+70 eow	709.07	0.60	8.4	Sandy silt over Bedrock
748	1073719.44	1464568.97	723.48	sta 34 0+80 tob	716.68	0.00	6.8	Sand over Bedrock
749	1073590.07	1464495.07	723.90	sta 35 0+00 tob	708.90	0.00	15	Sand over Bedrock
750	1073597.09	1464492.22	717.35	sta 35 0+10 eow	709.65	1.30	7.7	Sand over Bedrock
751	1073614.87	1464487.98	716.35	sta 35 0+20	709.45	2.10	6.9	Sand over Bedrock
752	1073631.67	1464487.50	716.32	sta 35 0+30	708.32	2.10	8	Sand over Bedrock
753	1073645.29	1464488.25	716.33	sta 35 0+40	709.53	2.20	6.8	Sand over Bedrock
754	1073654.03	1464471.74	717.04	sta 35 0+50	708.94	1.60	8.1	Sand over Bedrock
755	1073671.22	1464470.28	716.62	sta 35 0+60	707.12	2.00	9.5	Sand over Bedrock
756	1073688.27	1464461.43	718.73	sta 35 0+70 eow	709.03	0.80	9.7	Sand over Bedrock
757	1073699.75	1464466.92	722.99	sta 35 0+80 tob	717.49	0.00	5.5	Sand over Bedrock
758	1073692.09	1464386.91	723.85	sta 36 0+00 tob	714.35	0.00	9.5	Sand over Bedrock
759	1073674.50	1464389.28	718.03	sta 36 0+10 eow	709.03	0.00	9	Sand over Bedrock
760	1073656.60	1464394.05	717.29	sta 36 0+20	707.49	1.20	9.8	Sand over Bedrock
761	1073643.66	1464393.43	715.98	sta 36 0+30	708.18	2.50	7.8	Sand over Bedrock
762	1073630.16	1464399.31	716.20	sta 36 0+40	708.00	2.20	8.2	Sand over Bedrock
763	1073616.08	1464401.26	716.74	sta 36 0+50	709.64	2.00	7.1	Sand over Bedrock
764	1073601.43	1464400.31	716.16	sta 36 0+60	709.06	2.20	7.1	Sand over Bedrock
765	1073583.44	1464402.70	715.13	sta 36 0+75 eow	708.33	3.20	6.8	Sandy silt over Bedrock
766	1073571.26	1464404.65	724.39	sta 36 0+90 tob	710.19	0.00	14.2	Sand over Bedrock
767	1073548.91	1464307.53	723.61	sta 37 0+00 tob	709.61	0.00	14	Sand over Bedrock
768	1073564.32	1464310.26	715.70	sta 37 0+15 eow	710.20	2.50	5.5	Sand over Bedrock
769	1073578.09	1464309.34	714.97	sta 37 0+25	708.57	3.30	6.4	Sand over Bedrock
770	1073594.60	1464298.47	716.67	sta 37 0+35	708.67	1.70	8	Sand over Bedrock
771	1073610.66	1464295.04	716.89	sta 37 0+45	709.49	1.60	7.4	Sand over Bedrock
772	1073625.40	1464289.49	716.74	sta 37 0+55	704.64	1.70	12.1	Sand over Bedrock
773	1073642.29	1464286.26	717.20	sta 37 0+65	705.80	1.30	11.4	Sand over Bedrock
774	1073658.83	1464280.31	715.86	sta 37 0+80 ew	709.96	2.60	5.9	Sand over Bedrock
775	1073669.65	1464275.45	723.95	sta 37 0+90 tob	714.85	0.00	9.1	Sand over Bedrock
776	1073651.60	1464175.06	722.92	sta 38 0+00 tob	709.62	0.00	13.3	Sand over Bedrock
777	1073634.32	1464171.16	717.89	sta 38 0+10 eow	711.19	2.00	6.7	Sand over Bedrock
778	1073619.31	1464185.07	714.74	sta 38 0+20	703.84	3.60	10.9	Sand over Bedrock
779	1073607.73	1464183.08	716.26	sta 38 0+30	704.06	1.90	12.2	Sand over Bedrock
780	1073592.49	1464182.00	716.77	sta 38 0+40	706.37	1.60	10.4	Sand over Bedrock
781	1073576.72	1464181.77	716.05	sta 38 0+50	708.25	2.20	7.8	Sand over Bedrock
782	1073561.68	1464185.07	716.15	sta 38 0+60	706.75	2.60	9.4	Sand over Bedrock
783	1073544.40	1464201.17	723.62	sta 38 0+70 eow	714.92	1.80	8.6	Sand over Bedrock
784	1073533.62	1464202.02	723.22	sta 38 0+80 tob	710.22	0.00	13	Sand over Bedrock
785	1073500.01	1464135.71	721.93	sta 39 0+00 tob	708.93	0.00	13	Sand over Bedrock
786	1073518.24	1464125.73	718.17	sta 39 0+15 eow	707.17	0.00	11	Sand over Bedrock
787	1073532.17	1464119.72	716.95	sta 39 0+25	708.35	1.3	8.6	Sand over Bedrock
788	1073548.03	1464114.30	717.00	sta 39 0+35	706.20	1.30	10.8	Sand over Bedrock
789	1073563.70	1464109.36	716.80	sta 39 0+45	708.30	1.50	8.5	Sand over Bedrock
790	1073577.06	1464103.87	715.43	sta 39 0+55	707.43	2.90	8	Sand over Bedrock
791	1073589.86	1464095.00	713.97	sta 39 0+65	704.17	4.20	9.8	Sand over Bedrock
792	1073604.14	1464089.27	714.46	sta 39 0+80 eow	711.66	2.20	2.8	Sand over Bedrock
793	1073613.23	1464086.62	723.26	sta 39 0+85 tob	716.26	0.00	7	Sand over Bedrock
794	1073558.04	1463987.57	722.48	sta 40 0+00 tob	717.48	0.00	5	Sand over Bedrock
795	1073552.32	1463988.23	718.54	sta 40 0+05 eow	713.54	0.00	5	Sand over Bedrock
796	1073522.63	1464006.99	714.31	sta 40 0+25	706.71	3.90	7.6	Sand over Bedrock
797	1073514.72	1464016.21	715.84	sta 40 0+35	708.14	2.40	7.7	Sand over Bedrock
798	1073503.94	1464023.26	717.28	sta 40 0+45	710.48	1.10	6.8	Sand over Bedrock
799	1073490.10	1464035.27	718.18	sta 40 0+55 eow	708.28	0.00	9.9	Sand over Bedrock
800	1073473.14	1464049.06	718.96	sta 40 0+70 isld	709.96	0.00	9	Sand over Bedrock
801	1073462.90	1464058.18	718.48	sta 40 0+80 toe	708.48	0.00	10	Sand over Bedrock
802	1073454.95	1464081.44	722.51	sta 40 0+90 tob	710.51	0.00	12	Sand over Bedrock
803	1073390.73	1463994.06	722.02	sta 41 0+00 tob	707.32	0.00	14.7	Sand over Bedrock
804	1073403.27	1463982.08	718.68	sta 41 0+10 toe	707.28	0.00	11.3	Sand over Bedrock
805	1073423.37	1463985.48	718.29	sta 41 0+25 eow	708.39	0.00	9.9	Sand over Bedrock
806	1073439.47	1463967.23	716.64	sta 41 0+35	708.54	1.80	8.1	Sand over Bedrock
807	1073457.36	1463946.47	716.20	sta 41 0+45	709.00	2.10	7.2	Sand over Bedrock
808	1073469.83	1463936.47	715.20	sta 41 0+55	708.20	3.20	7	Sand over Bedrock
809	1073479.54	1463930.46	714.46	sta 41 0+65	708.76	3.90	5.7	Sand over Bedrock
810	1073493.84	1463909.26	714.83	sta 41 0+80 eow	713.93	3.30	0.9	Sand over Bedrock

Attachment 1
Pre-Dredge Bedrock and Sediment Survey Results

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

811	1073498.66	1463907.58	722.67	sta 41 0+90 tob	721.67	0.00	1	Sand over Bedrock
813	1073430.27	1463817.88	722.53	sta 42 0+00 tob	716.33	0.00	6.2	Sand over Bedrock
814	1073426.27	1463822.58	717.91	sta 42 0+05 eow	713.41	0.30	4.5	Sand over Bedrock
815	1073411.81	1463837.62	716.25	sta 42 0+15	708.75	2.00	7.5	Sand over Bedrock
816	1073399.97	1463847.48	716.02	sta 42 0+25	707.62	2.20	8.4	Sand over Bedrock
817	1073390.01	1463855.78	715.67	sta 42 0+35	708.07	2.50	7.6	Sand over Bedrock
818	1073377.48	1463866.20	716.04	sta 42 0+45	708.24	2.20	7.8	Sand over Bedrock
819	1073365.33	1463877.84	716.99	sta 42 0+55	708.39	1.20	8.6	Sand over Bedrock
820	1073351.49	1463891.08	717.32	sta 42 0+65	708.22	0.90	9.1	Sand over Bedrock
821	1073343.80	1463900.62	717.84	sta 42 0+75 eow	706.64	0.40	11.2	Sand over Bedrock
822	1073326.34	1463919.47	720.83	sta 42 0+95 tob	714.83	0.00	6	Sand over Bedrock
823	1073264.75	1463873.62	721.11	sta 43 0+00 tob	707.11	0.00	14	Sand over Bedrock
824	1073278.07	1463860.13	717.06	sta 43 0+10 eow	705.06	0.00	12	Sand over Bedrock
825	1073294.65	1463843.90	717.41	sta 43 0+20	707.21	0.80	10.2	Sand over Bedrock
826	1073307.79	1463832.42	717.06	sta 43 0+30	707.06	1.20	10	Sand over Bedrock
827	1073319.95	1463821.74	716.29	sta 43 0+40	706.19	1.90	10.1	Sand over Bedrock
828	1073331.54	1463812.45	715.97	sta 43 0+50	706.97	2.30	9	Sand over Bedrock
829	1073344.67	1463801.60	716.33	sta 43 0+60	707.23	1.90	9.1	Sand over Bedrock
830	1073362.67	1463786.44	715.77	sta 43 0+70	705.37	2.50	10.4	Sand over Bedrock
831	1073370.36	1463771.26	714.91	sta 43 0+85 eow	712.41	3.30	2.5	Sand over Bedrock
832	1073378.23	1463763.91	722.89	sta 43 0+95 tob	714.29	0.00	8.6	Sand over Bedrock
833	1073308.73	1463676.02	722.46	sta 44 0+00 tob	708.46	0.00	14	Sand over Bedrock
834	1073300.82	1463681.05	717.11	sta 44 0+10 eow	712.21	1.10	4.9	Sand over Bedrock
835	1073284.42	1463697.77	716.03	sta 44 0+20	705.93	2.20	10.1	Sand over Bedrock
836	1073267.00	1463707.49	716.19	sta 44 0+30	704.69	2.00	11.5	Sand over Bedrock
837	1073250.69	1463718.31	716.63	sta 44 0+40	705.63	1.50	11	Sand over Bedrock
838	1073235.18	1463733.86	716.63	sta 44 0+50	706.03	1.60	10.6	Sand over Bedrock
839	1073222.11	1463748.60	717.13	sta 44 0+60	704.83	1.00	12.3	Sand over Bedrock
840	1073185.25	1463782.44	716.50	sta 44 0+85 eow	714.20	1.70	2.3	Sand over Bedrock
841	1073180.17	1463766.48	721.08	sta 44 0+90 tob	717.08	0.00	4	Sand over Bedrock
842	1073121.40	1463669.81	720.87	sta 45 0+00 tob	712.87	0.00	8	Sand over Bedrock
843	1073125.31	1463669.30	718.19	sta 45 0+05 eow	717.69	0.00	0.5	Sand over Bedrock
844	1073140.68	1463658.33	716.60	sta 45 0+15	703.80	1.60	12.8	Sand over Bedrock
845	1073152.29	1463647.68	717.28	sta 45 0+25	704.18	0.90	13.1	Sand over Bedrock
846	1073170.52	1463635.61	716.45	sta 45 0+35	702.55	1.70	13.9	Sand over Bedrock
847	1073184.75	1463625.15	716.46	sta 45 0+45	702.76	1.70	13.7	Sand over Bedrock
848	1073206.11	1463610.80	716.69	sta 45 0+65	705.09	1.70	11.6	Sand over Bedrock
849	1073220.63	1463600.39	716.82	sta 45 0+75	704.62	1.30	12.3	Sand over Bedrock
850	1073241.00	1463583.19	717.30	sta 45 0+85 eow	709.00	0.70	8.3	Sand over Bedrock
851	1073248.20	1463587.57	721.88	sta 45 0+95 tob	710.58	0.00	11.3	Sand over Bedrock

Collection date: 02/19/10

Shot Number	Northing	Easting	Elevation(T/Sed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
852	1073176.191	1463503.165	722.03	sta 46 0+00 tob	719.83	0	2.2	Fine Sand Over Bedrock
853	1073171.055	1463505.491	717.90	sta 46 0+05 eow	704.90	0	13	Fine Sand Over Bedrock
854	1073164.187	1463512.946	717.24	sta 46 0+15	708.74	0.8	10.5	Fine Sand Over Bedrock
855	1073151.505	1463516.719	717.53	sta 46 0+25	702.53	0.5	15	Fine Sand Over Bedrock
856	1073132.248	1463530.104	716.57	sta 46 0+40	701.27	1.5	15.3	Fine Sand Over Bedrock
858	1073105.218	1463555.519	716.42	sta 46 0+60	701.72	1.5	14.7	Fine Sand Over Bedrock
859	1073078.041	1463572.389	719.68	sta 46 0+75	704.98	1.6	14.7	Fine Sand Over Bedrock
NA	*1073071.64*	*1463592.06*	719.84	sta 46 0+95 eow	714.84	0	5	Fine Sand Over Bedrock
NA	*1073065.43*	*1463597.76*	724.21	sta 46 1+00 tob	716.91	0	7.3	Fine Sand Over Bedrock
NA	*1073007.97*	*1463514.37*	720.39	sta 47 0+00 tob	717.49	0	2.9	Fine Sand Over Bedrock
NA	*1073014.18*	*1463509.19*	716.82	sta 47 0+05 eow	714.82	2	2	Fine Sand Over Bedrock
860	1073024.345	1463513.437	714.48	sta 47 0+15	702.88	3.4	11.6	Fine Sand Over Bedrock
861	1073046.017	1463511.31	716.44	sta 47 0+25	701.14	1.4	15.3	Fine Sand Over Bedrock
862	1073060.691	1463501.032	716.46	sta 47 0+40	702.96	1.5	13.5	Fine Sand Over Bedrock
863	1073075.96	1463488.265	716.22	sta 47 0+50	700.82	1.7	15.4	Fine Sand Over Bedrock
864	1073095.103	1463463.247	717.17	sta 47 0+65	702.37	0.7	14.8	Fine Sand Over Bedrock
865	1073111.915	1463453.452	717.45	sta 47 0+80	702.65	0.6	14.8	Fine Sand Over Bedrock
866	1073126.928	1463447.301	717.79	sta 47 0+95 eow	702.49	0	15.3	Fine Sand Over Bedrock
867	1073140.14	1463435.671	722.50	sta 47 1+05 tob	706.90	0	15.6	Fine Sand Over Bedrock
868	1073090.929	1463361.691	721.48	sta 48 0+00 tob	704.68	0	16.8	Fine Sand Over Bedrock
869	1073068.306	1463373.471	717.76	sta 48 0+10	700.06	0	17.7	Fine Sand Over Bedrock
870	1073049.794	1463391.151	717.88	sta 48 0+20 eow	701.68	0	16.2	Fine Sand Over Bedrock
871	1073033.673	1463403.869	716.36	sta 48 0+30	701.16	1.5	15.2	Fine Sand Over Bedrock
872	1073013.81	1463420.649	716.67	sta 48 0+50	700.87	1.1	15.8	Fine Sand Over Bedrock
873	1072992.606	1463429.556	715.10	sta 48 0+60	701.40	2.7	13.7	Fine Sand Over Bedrock
874	1072979.46	1463447.016	714.72	sta 48 0+70	704.92	2.9	9.8	Fine Sand Over Bedrock
875	1072967.49	1463450.634	716.04	sta 48 0+80 eow	711.64	1.8	4.4	Fine Sand Over Bedrock
NA	*1072960.31*	*1463452.89*	720.28	sta 48 0+90 tob	720.28	0	0	Bedrock

Attachment 1
Pre-Dredge Bedrock and Sediment Survey Results

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

Collection date: 02/20/10

Shot Number	Northing	Easting	Elevation(T/Sed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
877	1073034.213	1463268.671	721.45	sta 49 0+00 tob	708.15	0	13.3	Fine Sand over Bedrock
878	1073012.679	1463281.216	718.50	sta 49 0+15	703.50	0	15	Fine Sand over Bedrock
879	1072997.479	1463290.11	717.69	sta 49 0+30 eow	699.69	0	18	Fine Sand over Bedrock
880	1072983.228	1463308.718	716.45	sta 49 0+40	699.15	1.2	17.3	Fine Sand over Bedrock
881	1072965.205	1463332.481	715.65	sta 49 0+60	699.15	2	16.5	Fine Sand over Bedrock
882	1072952.802	1463344.123	715.71	sta 49 0+60	698.01	1.9	17.7	Fine Sand over Bedrock
883	1072936.421	1463358.875	715.44	sta 49 0+75	701.34	2.2	14.1	Fine Sand over Bedrock
884	1072921.424	1463376.719	715.25	sta 49 0+90 eow	708.75	2	6.5	Fine Sand over Bedrock
885	1072914.05	1463377.815	721.08	sta 49 1+00 tob	716.08	0	5	Fine Sand over Bedrock
886	1072847.637	1463299.172	721.85	sta 50 0+00 tob	714.85	0	7	Fine Sand over Bedrock
887	1072852.498	1463293.777	716.89	sta 50 0+05 eow	711.29	0.7	5.6	Fine Sand over Bedrock
888	1072863.403	1463278.398	716.04	sta 50 0+20	699.14	1.6	16.9	Fine Sand over Bedrock
889	1072887.38	1463261.944	716.40	sta 50 0+35	695.60	1.2	20.8	Fine Sand over Bedrock
890	1072906.732	1463249.129	716.44	sta 50 0+45	697.64	1.2	18.8	Fine Sand over Bedrock
891	1072924.774	1463229.567	715.98	sta 50 0+60	698.98	1.7	17	Fine Sand over Bedrock
892	1072944.199	1463216.951	716.09	sta 50 0+70	699.19	1.5	16.9	Fine Sand over Bedrock
893	1072987.569	1463208.372	717.49	sta 50 0+85 eow	704.89	0	12.6	Fine Sand over Bedrock
894	1072978.115	1463197.658	720.80	sta 50 0+95 tob	707.60	0	13.2	Fine Sand over Bedrock
NA	*1072894.86*	*1463085.87*	721.23	sta 51 0+00 tob	719.73	0	1.5	Fine Sand over Bedrock
895	1072891.634	1463092.227	722.46	sta 51 0+05 eow	715.46	1.7	7	Fine Sand over Bedrock
896	1072870.964	1463107.181	715.71	sta 51 0+20	703.11	1.7	12.6	Fine Sand over Bedrock
897	1072859.31	1463127.795	715.81	sta 51 0+30	697.91	1.7	17.9	Fine Sand over Bedrock
898	1072837.723	1463149.997	716.21	sta 51 0+40	697.51	1.3	18.7	Fine Sand over Bedrock
899	1072817.792	1463167.181	716.41	sta 51 0+55	697.71	1.1	18.7	Fine Sand over Bedrock
900	1072793.642	1463188.035	716.63	sta 51 0+70	699.03	0.9	17.6	Fine Sand over Bedrock
901	1072773.671	1463213.553	716.98	sta 51 0+80 eow	703.98	0.5	13	Fine Sand over Bedrock
902	1072767.003	1463220.62	721.85	sta 51 0+90 tob	712.55	0	9.3	Fine Sand over Bedrock
903	1072893.76	1463141.639	720.99	sta 52 0+00 tob	713.69	0	7.3	Fine Sand over Bedrock
904	1072698.421	1463132.941	716.77	sta 52 0+05 eow	703.67	0.6	13.1	Fine Sand over Bedrock
905	1072712.653	1463117.849	717.88	sta 52 0+20	701.28	0	16.6	Fine Sand over Bedrock
906	1072738.357	1463094.794	716.74	sta 52 0+40	698.84	0.6	17.9	Fine Sand over Bedrock
907	1072755.53	1463083.368	715.60	sta 52 0+55	696.00	1.9	19.6	Fine Sand over Bedrock
908	1072772.435	1463069.455	715.56	sta 52 0+55	695.56	1.9	20	Fine Sand over Bedrock
909	1072789.237	1463058.231	715.93	sta 52 0+75	696.33	1.5	19.6	Fine Sand over Bedrock
910	1072810.001	1463034.485	714.65	sta 52 0+90 eow	713.95	1.8	0.7	Fine Sand over Bedrock
911	1072814.312	1463035.482	721.56	sta 52 1+00 tob	721.56	0	0	BedRock

Collection date: 02/21/10

Shot Number	Northing	Easting	Elevation(T/Sed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
912	1072747.791	1462954.662	722.16	sta 53 0+00 tob	719.06	0	3.1	Fine Sand Over Bedrock
913	1072742.552	1462960.729	713.88	sta 53 0+05 eow	712.68	1.7	1.2	Fine Sand Over Bedrock
914	1072727.361	1462969.38	714.45	sta 53 0+20	697.35	2.9	17.1	Fine Sand Over Bedrock
1136	1072701.485	1462998.279	714.10	sta 53a 0+30	694.60	2.5	19.5	Fine Sand Over Bedrock
1135	1072683.481	1463013.461	715.32	sta 53a 0+40	691.62	1.3	23.7	Fine Sand Over Bedrock
1134	1072656.33	1463041.467	717.47	sta 53a 0+55	699.17	0	18.3	Fine Sand Over Bedrock
918	1072654.581	1463033.401	717.36	sta 53 0+65	699.86	0	17.5	Fine Sand Over Bedrock
919	1072635.536	1463054.429	717.14	sta 53 0+80 eow	702.34	0.2	14.8	Fine Sand Over Bedrock
920	1072621.149	1463056.184	721.38	sta 53 0+90 tob	704.38	0	17	Fine Sand Over Bedrock
921	1072553.64	1462982.128	722.04	sta 54 0+00 tob	702.04	0	20	Fine Sand Over Bedrock
922	1072562.889	1462970.409	717.18	sta 54 0+10 eow	697.18	0	20	Fine Sand Over Bedrock
923	1072582.819	1462951.826	716.54	sta 54 0+20	697.24	0.7	19.3	Fine Sand Over Bedrock
1133	1072620.754	1462903.798	715.98	sta 54a 0+35	693.78	1.3	22.2	Fine Sand Over Bedrock
1132	1072631.259	1462889.967	716.01	sta 54a 0+45	697.81	1.3	18.2	Fine Sand Over Bedrock
926	1072638.071	1462899.486	715.25	sta 54 0+60	695.35	2.1	19.9	Fine Sand Over Bedrock
927	1072665.911	1462878.761	714.87	sta 54 0+75	698.27	2.4	16.6	Fine Sand Over Bedrock
928	1072666.264	1462863.972	716.95	sta 54 0+85 eow	712.35	0.4	4.6	Fine Sand Over Bedrock
929	1072672.146	1462856.48	722.07	sta 54 0+95 tob	718.07	0	4	Fine Sand Over Bedrock
930	1072620.618	1462789.715	721.62	sta 55 0+00 tob	718.92	0	2.7	Fine Sand Over Bedrock
931	1072613.829	1462795.736	716.58	sta 55 0+10 eow	710.18	0.4	6.4	Fine Sand Over Bedrock
932	1072600.652	1462805.049	716.64	sta 55 0+20	709.94	1.6	5.7	Fine Sand Over Bedrock
933	1072584.398	1462821.309	715.74	sta 55 0+45	698.14	1.6	17.6	Fine Sand Over Bedrock
934	1072564.058	1462839.826	716.31	sta 55 0+60	697.71	0.9	18.6	Fine Sand Over Bedrock
1131	1072541.585	1462870.13	716.15	sta 55a 0+80	695.25	1.1	20.9	Fine Sand Over Bedrock
1130	1072516.845	1462881.903	716.22	sta 55a 1+00	694.22	1	22	Fine Sand Over Bedrock
937	1072493.177	1462912.673	716.83	sta 55 1+20 eow	699.23	0.4	17.6	Fine Sand Over Bedrock
938	1072488.902	1462917.265	720.01	sta 55 1+25 tob	703.91	0	16.1	Fine Sand Over Bedrock
939	1072445.05	1462863.338	719.97	sta 56 0+00 tob	713.77	0	6.2	Fine Sand Over Bedrock
940	1072446.838	1462860.96	714.09	sta 56 0+05 eow	706.49	3	7.6	Fine Sand Over Bedrock

Attachment 1
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Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

1128	1072490.724	1462824.725	715.73	sta 56a 0+30	693.33	1.4	22.4	Fine Sand Over Bedrock
1127	1072506.796	1462806.425	716.43	sta 56a 0+55	694.13	0.7	22.3	Fine Sand Over Bedrock
1126	1072521.676	1462788.305	717.79	sta 56a 0+80	693.29	0	24.5	Fine Sand Over Bedrock
1125	1072534.317	1462772.95	717.21	sta 56a 1+10	693.21	0	24	Fine Sand Over Bedrock
945	1072553.92	1462758.383	716.02	sta 56 1+35	703.02	3.2	12	Fine Sand Over Bedrock
946	1072566.47	1462743.91	716.35	sta 56 1+50 eow	709.15	0.8	7.2	Fine Sand Over Bedrock
947	1072573.78	1462743.91	721.39	sta 56 1+60 tob	717.39	0	4	Fine Sand Over Bedrock

Collection date: 02/22/10

Shot Number	Northing	Easting	Elevation(T/Sed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
948	1072379.14	1462777.57	719.95	sta 57 0+00 tob	714.95	0	5	Fine Sand Over Bedrock
949	1072385.77	1462778.00	717.45	sta 57 0+05 eow	712.15	0	5.3	Fine Sand Over Bedrock
950	1072403.25	1462783.93	714.26	sta 57 0+25	699.66	3	14.6	Fine Sand Over Bedrock
1124	1072415.322	1462730.389	716.01	sta 57a 0+55	696.21	1.2	19.8	Fine Sand Over Bedrock
1123	1072449.174	1462707.622	717.62	sta 57a 0+85	692.52	0	25	Fine Sand Over Bedrock
1122	1072468.065	1462688.355	715.74	sta 57a 1+00	693.74	1.5	22	Fine Sand Over Bedrock
954	1072473.58	1462675.52	715.65	sta 57 1+20	699.05	1.7	16.5	Fine Sand Over Bedrock
955	1072491.06	1462659.28	717.17	sta 57 1+35 eow	711.17	0	6	Fine Sand Over Bedrock
956	1072499.55	1462649.77	721.27	sta 57 1+45 tob	719.27	0	2	Fine Sand Over Bedrock
957	1072427.07	1462578.46	721.18	sta 58 0+00 tob	718.38	0	2.8	Fine Sand Over Bedrock
958	1072422.39	1462586.50	717.42	sta 58 0+05 eow	712.82	0	4.6	Fine Sand Over Bedrock
959	1072407.30	1462594.98	717.29	sta 58 0+25	700.29	0	17	Fine Sand Over Bedrock
1121	1072397.757	1462626.397	716.22	sta 58a 0+55	693.62	0.9	22.8	Fine Sand Over Bedrock
1120	1072378.628	1462637.9	715.28	sta 58a 0+75	693.08	1.8	22.2	Fine Sand Over Bedrock
1119	1072356.032	1462652.622	714.53	sta 58a 1+00	687.03	2.5	27.5	Fine Sand Over Bedrock
963	1072326.54	1462674.82	716.09	sta 58 1+30	698.09	1	18	Fine Sand Over Bedrock
964	1072301.06	1462670.41	715.46	sta 58 1+50 eow	715.46	1.7	0	Fine Sand Over Bedrock
965	1072299.17	1462674.50	720.96	sta 58 1+55 tob	717.96	0	3	Fine Sand Over Bedrock
966	1072237.81	1462614.71	718.76	sta 59 0+00 tob	718.76	0	0	Fine Sand Over Bedrock
967	1072243.66	1462604.94	716.95	sta 59 0+15 eow	702.95	0	14	Fine Sand Over Bedrock
1116	1072278.024	1462594.32	714.77	sta 59a 0+35	694.17	2.4	20.6	Fine Sand Over Bedrock
969	1072276.61	1462582.08	714.81	sta 59 0+55	700.11	2.3	14.7	Fine Sand Over Bedrock
1117	1072292.24	1462576.615	714.78	sta 59a 0+75	692.08	1.3	22.7	Fine Sand Over Bedrock
1118	1072311.096	1462556.278	715.02	sta 59a 0+100	693.42	2.4	21.6	Fine Sand Over Bedrock
972	1072317.99	1462544.85	715.64	sta 59 1+25	703.14	1.5	12.5	Fine Sand Over Bedrock
973	1072332.24	1462526.89	713.94	sta 59 1+35 eow	712.34	2.4	1.6	Fine Sand Over Bedrock
974	1072335.31	1462520.27	718.12	sta 59 1+40 tob	716.12	0	2	Fine Sand Over Bedrock
975	1072262.71	1462464.35	720.86	sta 60 0+00 tob	716.56	0	4.3	Fine Sand Over Bedrock
976	1072258.56	1462470.85	716.96	sta 60 0+5 eow	710.26	0	6.7	Fine Sand Over Bedrock
977	1072245.84	1462488.62	713.79	sta 60 0+25	698.09	3.3	15.7	Fine Sand Over Bedrock
NA	1072233.51	1462506.74	715.31	sta 60 0+45	693.71	1.70	21.6	Fine Sand Over Bedrock
1113	1072227.117	1462505.403	715.63	sta 60a 0+55	692.93	1:30	22.7	Fine Sand Over Bedrock
1112	1072204.819	1462519.305	715.57	sta 60a 0+80	689.97	1:40	25.6	Fine Sand Over Bedrock
1111	1072196.171	1462539.291	715.48	sta 60a 1+00	689.88	1:40	25.6	Fine Sand Over Bedrock
982	1072188.52	1462570.08	716.70	sta 60 1+15 eow	700.70	0.00	16	Fine Sand Over Bedrock
983	1072177.47	1462579.39	719.21	sta 60 1+25 tob	709.71	0.00	9.5	Fine Sand Over Bedrock
984	1072067.89	1462607.79	719.48	sta 61 0+00 tob	714.48	0.00	5	Fine Sand Over Bedrock
985	1072072.69	1462603.79	716.62	sta 61 0+05 eow	702.62	0.00	14	Fine Sand Over Bedrock
1110	1072067.881	1462489.13	715.64	sta 61a 0+20	689.14	1:20	26.5	Fine Sand Over Bedrock
1109	1072107.305	1462470.115	715.93	sta 61a 0+45	684.93	1:00	31	Fine Sand Over Bedrock
1108	1072120.026	1462452.933	715.83	sta 61a 0+60	686.93	1:10	28.9	Fine Sand Over Bedrock
1107	1072141.534	1462432.471	715.30	sta 61a 0+80	682.90	1:60	32.4	Fine Sand Over Bedrock
1106	1072147.397	1462412.844	714.58	sta 61a 1+05	695.88	2.30	18.7	Fine Sand Over Bedrock
991	1072160.26	1462395.02	718.55	sta 61 1+20 eow	717.95	0.00	0.6	Fine Sand Over Bedrock
992	1072162.19	1462389.92	721.62	sta 61 1+25 tob	720.12	0.00	1.5	Fine Sand Over Bedrock
993	1072101.66	1462334.36	721.57	sta 62 0+00 tob	720.07	0.00	1.5	Fine Sand Over Bedrock
994	1072100.56	1462340.70	717.09	sta 62 0+05 eow	710.79	0.00	6.3	Fine Sand Over Bedrock
1105	1072082.513	1462367.003	714.14	sta 62a 0+30	688.34	2.70	25.8	Fine Sand Over Bedrock
1104	1072062.053	1462361.187	714.73	sta 62a 0+55	684.43	2.20	30.3	Fine Sand Over Bedrock
1103	1072047.625	1462401.963	715.55	sta 62a 0+80	685.45	1:40	30.1	Fine Sand Over Bedrock
1102	1072025.468	1462425.999	715.60	sta 62a 1+10	689.80	1.20	25.8	Fine Sand Over Bedrock
1101	1071992.855	1462429.982	714.53	sta 62a 1+35	694.83	2.30	19.7	Fine Sand Over Bedrock
1003	1071988.26	1462454.516	716.88	sta 62 1+50 eow	710.28	0.00	6.6	Fine Sand Over Bedrock
1004	1071987.172	1462460.662	720.46	sta 62 1+55 tob	715.46	0.00	5	Fine Sand Over Bedrock

Collection date: 02/23/10

Shot Number	Northing	Easting	Elevation(T/Sed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
1005	1071908.63	1462388.13	720.63	sta 63 0+00 tob	714.13	0	6.5	Fine Sand Over Bedrock
1006	1071915.53	1462381.97	715.02	sta 63 0+10 eow	709.32	2.1	5.7	Fine Sand Over Bedrock
1099	1071932.911	1462374.017	714.24	sta 63a 0+30	693.44	2.8	20.8	Fine Sand Over Bedrock
1098	1071961.956	1462345.433	715.41	sta 63a 0+55	688.81	1.4	26.6	Fine Sand Over Bedrock

Attachment 1
Pre-Dredge Bedrock and Sediment Survey Results

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

1097	1071976.011	1462331.093	715.14	sta 63a 0+80	685.94	1.8	29.2	Fine Sand Over Bedrock
1096	1071995.41	1462319.1	715.05	sta 63a 1+00	690.25	1.9	24.8	Fine Sand Over Bedrock
1095	1072024.749	1462288.39	715.56	sta 63a 1+30	695.66	1.3	19.9	Fine Sand Over Bedrock
1012	1072037.36	1462276.79	716.79	sta 63 1+50 eow	708.29	0	8.5	Fine Sand Over Bedrock
1013	1072040.62	1462264.07	721.88	sta 63 1+55 tob	719.38	0	2.5	Fine Sand Over Bedrock
1014	1071970.44	1462200.74	721.02	sta 64 0+00 tob	719.12	0	1.9	Fine Sand Over Bedrock
1015	1071967.07	1462206.81	716.82	sta 64 0+05 eow	712.02	0	4.8	Fine Sand Over Bedrock
1094	1071967.784	1462237.871	715.62	sta 64a 0+30	691.92	1.3	23.7	Fine Sand Over Bedrock
1093	1071949.669	1462263.019	715.65	sta 64a 0+55	683.75	1.3	31.9	Fine Sand Over Bedrock
1092	1071921.239	1462286.289	715.61	sta 64a 0+80	685.61	1.3	30	Fine Sand Over Bedrock
1091	1071903.254	1462278.041	715.47	sta 64a 1+20	684.67	1.5	30.8	Fine Sand Over Bedrock
1090	1071874.038	1462301.323	714.30	sta 64a 1+60	687.90	2.6	26.4	Fine Sand Over Bedrock
1021	1071848.89	1462320.75	715.02	sta 64 1+65 eow	714.02	2	1	Fine Sand Over Bedrock
1022	1071841.91	1462326.01	721.48	sta 64 1+70 tob	718.98	0	2.5	Fine Sand Over Bedrock
1023	1071771.30	1462249.02	720.58	sta 65 0+00 tob	713.58	0	7	Fine Sand Over Bedrock
1024	1071785.22	1462255.45	714.41	sta 65 0+05 eow	713.81	2.6	0.6	Fine Sand Over Bedrock
1089	1071820.317	1462216.887	715.18	sta 65a 0+25	685.38	1.3	29.8	Fine Sand Over Bedrock
1088	1071839.191	1462191.521	715.66	sta 65a 0+50	685.86	1.7	29.7	Fine Sand Over Bedrock
1086	1071850.522	1462175.173	716.64	sta 65a 0+85	683.54	0.3	33.1	Fine Sand Over Bedrock
1085	1071866.346	1462159.797	716.26	sta 65a 1+10	682.96	0.7	33.3	Fine Sand Over Bedrock
1084	1071884.923	1462142.144	715.93	sta 65a 1+40	685.93	1	30	Fine Sand Over Bedrock
1030	1071911.31	1462142.09	715.55	sta 65 1+60 eow	711.75	1.2	3.8	Fine Sand Over Bedrock
1031	1071915.72	1462134.44	720.71	sta 65 1+65 tob	719.21	0	1.5	Fine Sand Over Bedrock
1032	1071856.89	1462033.43	721.30	sta 66 0+00 tob	717.80	0	3.5	Fine Sand Over Bedrock
1033	1071850.06	1462035.44	716.39	sta 66 0+05 eow	716.09	0.2	0.3	Fine Sand Over Bedrock
1083	1071838.335	1462076.489	716.26	sta 66a 0+25	682.36	0.7	33.9	Fine Sand Over Bedrock
1082	1071816.202	1462090.962	715.95	sta 66a 0+55	694.95	1	21	Fine Sand Over Bedrock
1081	1071784.239	1462109.745	716.22	sta 66a 0+90	682.92	0.7	33.3	Fine Sand Over Bedrock
1080	1071753.592	1462120.928	714.96	sta 66a 1+25	685.86	1.9	29.1	Fine Sand Over Bedrock
1038	1071731.46	1462107.55	713.73	sta 66 1+45	697.93	3.2	15.8	Fine Sand Over Bedrock
1039	1071703.78	1462119.94	721.66	sta 66 1+60 tob	720.26	2.8	1.4	Fine Sand Over Bedrock
1040	1071707.84	1462113.38	714.24	sta 66 1+55 eow	714.04	0	0.2	Fine Sand Over Bedrock
1041	1071673.89	1462042.35	720.96	sta 67 0+00 tob	717.96	0	3	Fine Sand Over Bedrock
1042	1071677.53	1462038.13	716.48	sta 67 0+05 eow	716.38	3.9	0.1	Fine Sand Over Bedrock
1043	1071715.53	1462023.66	713.22	sta 67 0+30	690.12	3.6	23.1	Fine Sand Over Bedrock
1079	1071715.115	1462043.642	712.89	sta 67a 0+55	686.89	4	26	Fine Sand Over Bedrock
1078	1071727.954	1462033.772	715.17	sta 67a 0+80	683.87	1.7	31.3	Fine Sand Over Bedrock
1077	1071755.991	1462016.222	716.64	sta 67a 1+05	679.64	0	37	Fine Sand Over Bedrock
1076	1071788.506	1461997.031	716.84	sta 67a 1+30	680.54	0	36.3	Fine Sand Over Bedrock
1048	1071807.78	1461983.02	714.31	sta 67 1+45 eow	709.91	2.6	4.4	Fine Sand Over Bedrock
1049	1071809.87	1461983.97	720.72	sta 67 1+50 tob	720.72	0	0	Fine Sand Over Bedrock

Collection date: 03/02/10

Shot Number	Northing	Easting	Elevation(T/Bed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
NA	1074791.024	1466010.126	764.17	sta12 0+00 tob	758.17	0	6	Fine Sand over Bedrock
NA	1074800.362	1466012.789	760.34	sta12 0+05 eow	755.64	0.3	4.7	Fine Sand over Bedrock
NA	1074823.895	1466009.038	757.39	sta12 0+25	746.89	3.5	11.5	Fine Sand over Bedrock
NA	1074851.397	1466002.105	758.21	sta12 0+45	740.11	2.6	18.1	Fine Sand over Bedrock
NA	1074880.755	1465976.892	759.30	sta12 0+65	739.70	1.5	19.6	Fine Sand over Bedrock
NA	1074894.17	1465961.16	759.44	sta12 0+85	737.34	0.9	22.1	Fine Sand over Bedrock
NA	1074919.8	1465939.897	759.31	sta12 1+05	737.11	0.8	22.2	Fine Sand over Bedrock
NA	1074943.162	1465931.991	761.27	sta12 1+25	737.27	0	24	Fine Sand over Bedrock
NA	1074955.722	1465900.78	759.76	sta12 1+45 EOW	737.16	0.8	22.6	Fine Sand over Bedrock
NA	1074983.475	1465886.569	763.16	sta12 1+50 TOB	735.86	0	27.3	Fine Sand over Bedrock
NA	1075032.534	1466016.953	763.51	sta11 0+00 TOB	744.01	0	19.5	Fine Sand over Bedrock
NA	1075025.173	1466020.917	759.38	sta11 0+05 EOW	741.18	0.8	18.2	Fine Sand over Bedrock
NA	1075003.396	1466037.334	759.13	sta11 0+25	738.03	1.1	21.1	Fine Sand over Bedrock
NA	1074979.687	1466049.599	759.04	sta11 0+45	738.24	1.2	20.8	Fine Sand over Bedrock
NA	1074954.632	1466060.422	763.83	sta11 0+65	736.83	0	27	Fine Sand over Bedrock
NA	1074962.209	1466056.793	759.90	sta11 0+85	732.60	0.7	27.3	Fine Sand over Bedrock
NA	1074846.19	1466061.792	757.924072	sta 11 1+05	739.82	1.9	18.1	Fine Sand over Bedrock
NA	1074826.052	1466070.012	759.542109	sta 11 1+30 eow	757.74	3.2	1.8	Fine Sand over Bedrock
NA	1074815.422	1466073.939	763.991604	sta 11 1+35 tob	757.99	0	6	Fine Sand over Bedrock

Collection date: 03/03/10

Shot Number	Northing	Easting	Elevation(T/Bed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
NA	1074853.645	1466191.548	763.61	sta 10+00 tob	754.61	0	9	Fine Sand Over Bedrock
NA	1074862.945	1466192.158	757.06	sta 10+05 eow	754.56	4.5	2.5	Fine Sand Over Bedrock
NA	1074886.225	1466180.082	758.38	sta 10+25	750.78	2.5	7.6	Fine Sand Over Bedrock
NA	1074917.297	1466167.342	758.78	sta 10+55	741.68	2	17.1	Fine Sand Over Bedrock
NA	1074951.628	1466147.46	759.18	sta 10+85	739.78	0.7	19.4	Fine Sand Over Bedrock

Attachment 1
Pre-Dredge Bedrock and Sediment Survey Results

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

NA	1074980.219	1466135.346	766.81	sta 10+105	741.11	0	25.7	Fine Sand Over Bedrock
NA	1075031.658	1466101.425	763.16	sta 10+135	741.16	1	22	Fine Sand Over Bedrock
NA	1075061.475	1466086.035	760.36	sta 10+160 eow	743.86	0.5	16.5	Fine Sand Over Bedrock
NA	1075069.284	1466076.735	762.19	sta 10+170 tob	754.19	0	8	Fine Sand Over Bedrock
NA	1074871.488	1465734.565	763.20	sta 14 0+00 tob	747.70	0	15.5	Fine Sand Over Bedrock
NA	1074867.976	1465736.575	757.95	sta 14 0+05 eow	742.05	3.1	15.9	Fine Sand Over Bedrock
NA	1074849.043	1465750.196	756.15	sta 14 0+25	737.65	3.5	18.5	Fine Sand Over Bedrock
NA	1074831.786	1465761.532	758.15	sta 14 0+45	739.35	3.2	18.8	Fine Sand Over Bedrock
NA	1074819.389	1465770.182	758.15	sta 14 0+65	735.85	2	22.3	Fine Sand Over Bedrock
NA	1074801.655	1465782.719	758.96	sta 14 0+85	736.66	2.3	22.3	Fine Sand Over Bedrock
NA	1074780.419	1465799.705	758.89	sta 14 1+05	732.99	2.1	25.9	Fine Sand Over Bedrock
NA	1074757.613	1465819.864	758.89	sta 14 1+30	736.29	1.9	22.6	Fine Sand Over Bedrock
NA	1074751.193	1465825.309	757.35	sta 14 1+70	739.25	3.4	18.1	Fine Sand Over Bedrock
NA	1074795.987	1465917.312	760.69	sta 13+00	739.69	0	21	Fine Sand Over Bedrock
NA	1074805.349	1465910.131	759.61	sta 13+20	741.21	1.2	18.4	Fine Sand Over Bedrock
NA	1074824.793	1465894.496	757.69	sta 13 0+40	736.79	3.2	20.8	Fine Sand Over Bedrock
NA	1074841.711	1465886.699	758.33	sta 13 0+60	738.83	2.5	19.5	Fine Sand Over Bedrock
NA	1074858.438	1465872.405	758.39	sta 13 0+80	734.39	2	24	Fine Sand Over Bedrock
NA	1074878.227	1465861.435	758.90	sta 13.1+00	735.60	1.9	23.3	Fine Sand Over Bedrock
NA	1074891.255	1465858.939	758.59	sta 13.1+20	735.79	2.2	22.8	Fine Sand Over Bedrock
NA	1074905.463	1465846.547	760.74	sta 13 1+40 eow	735.54	0.2	25.2	Fine Sand Over Bedrock
NA	1074934.312	1465840.751	763.38	sta 13 1+60 tob	736.78	0	26.6	Fine Sand Over Bedrock
NA	1074870.131	1466277.954	762.51	sta 9 0+00 tob	748.01	0	14.5	Fine Sand Over Bedrock
NA	1074889.213	1466269.535	759.31	sta 9 0+10 eow	746.01	1.1	13.3	Fine Sand Over Bedrock
NA	1074908.164	1466259.521	758.74	sta 9 0+30	741.64	2.1	17.1	Fine Sand Over Bedrock
NA	1074922.648	1466243.668	758.23	sta 9 0+50	740.43	2.6	17.8	Fine Sand Over Bedrock
NA	1074952.914	1466228.973	758.66	sta 9 0+75	740.76	1.9	18.1	Fine Sand Over Bedrock
NA	1074996.147	1466212.686	760.55	sta 9 0+95	741.85	0.2	18.7	Fine Sand Over Bedrock
NA	1075091.325	1466178.904	758.88	sta 9 1+10	743.78	1.9	15.1	Fine Sand Over Bedrock
NA	1075095.778	1466177.186	759.02	sta 9 1+20	744.82	1.8	14.2	Fine Sand Over Bedrock
NA	1075104.635	1466174.249	763.51	sta 9 1+25 tob	749.21	0	14.3	Fine Sand Over Bedrock

Collection date: 03/04/10

Shot Number	Northing	Easting	Elevation(T/Bed)	Probe ID	Elevation(Bedrock)	Water Depth	Probe Depth	Description
NA	1075120.106	1466311.492	762.42	sta 8 0+00 tob	749.22	0	13.2	Fine Sand Over Bedrock
NA	1075093.103	1466319.421	760.49	sta 8 0+05 eow	740.49	0.4	20	Fine Sand Over Bedrock
NA	1075070.385	1466321.51	760.21	sta 8 0+25	740.51	0.7	19.7	Fine Sand Over Bedrock
NA	1075045.613	1466325.98	759.74	sta 8 0+45	740.44	1.1	19.3	Fine Sand Over Bedrock
NA	1075015.621	1466332.236	759.23	sta 8 0+65	741.43	1.7	17.8	Fine Sand Over Bedrock
NA	1074990.504	1466336.803	758.76	sta 8 0+85	740.46	2.1	18.3	Fine Sand Over Bedrock
NA	1074969.439	1466346.377	757.91	sta 8 1+05	740.41	2.9	17.5	Fine Sand Over Bedrock
NA	1074946.237	1466351.059	758.97	sta 8 1+25 eow	740.77	1.8	18.2	Fine Sand Over Bedrock
NA	1074914.685	1466373.162	762.46	sta 8 1+45tob	742.96	0	19.5	Fine Sand Over Bedrock
NA	1074939.634	1466475.582	763.80	sta 7 0+00 tob	746.80	0	17	Fine Sand Over Bedrock
NA	1074963.363	1466458.482	760.13	sta 7 0+10 eow	745.83	0.7	14.3	Fine Sand Over Bedrock
NA	1074985.897	1466446.095	760.11	sta 7 0+30	742.21	0.7	17.9	Fine Sand Over Bedrock
NA	1075015.457	1466434.279	758.72	sta 7 0+50	742.92	2.1	15.8	Fine Sand Over Bedrock
NA	1075045.095	1466425.121	758.54	sta 7 0+70	742.24	2.2	16.3	Fine Sand Over Bedrock
NA	1075064.955	1466421.702	758.94	sta 7 0+90	743.64	1.9	15.4	Fine Sand Over Bedrock
NA	1075088.248	1466419.902	759.30	sta 7 0+110	741.20	1.6	18.1	Fine Sand Over Bedrock
NA	1075110.533	1466412.067	760.21	sta 7 0+130eow	744.91	0.7	15.3	Fine Sand Over Bedrock
NA	1075128.148	1466410.863	764.42	sta 7 0+140tob	758.42	0	6	Fine Sand Over Bedrock
NA	1075131.629	1466532.375	764.64	sta 6 0+00tob	761.94	0	2.7	Fine Sand Over Bedrock
NA	1075121.943	1466525.357	758.16	sta 6 0+20 eow	754.86	2.4	3.3	Fine Sand Over Bedrock
NA	1075097.031	1466530.849	757.58	sta 6 0+20	744.38	3.4	13.2	Fine Sand Over Bedrock
NA	1075084.464	1466531.753	757.55	sta 6 0+40	744.65	3.3	12.9	Fine Sand Over Bedrock
NA	1075066.83	1466534.634	758.40	sta 6 0+60	744.30	2.5	14.1	Fine Sand Over Bedrock
NA	1075045.02	1466538.246	759.23	sta 6 0+80	746.53	1.7	12.7	Fine Sand Over Bedrock
NA	1075018.729	1466541.587	760.55	sta 6 1+00	745.95	0.7	14.6	Fine Sand Over Bedrock
NA	1074976.015	1466558.983	760.50	sta 6 1+15eow	744.30	0.3	16.2	Fine Sand Over Bedrock
NA	1074962.095	1466550.006	764.58	sta 6 1+20tob	745.38	0	19.2	Fine Sand Over Bedrock
NA	107500466	1466639.194	762.46	sta 5 0+00 tob	744.16	0	18.3	Fine Sand Over Bedrock
NA	1075011.051	1466637.992	760.37	sta 5 0+10 eow	745.37	0.5	15	Fine Sand Over Bedrock
NA	1075037.924	1466630.581	760.85	sta 5 0+30	746.85	0	14	Fine Sand Over Bedrock
NA	1075063.393	1466622.716	760.28	sta 5 0+50	745.08	0.5	15.2	Fine Sand Over Bedrock
NA	1075084.414	1466614.905	759.64	sta 5 0+70	744.64	1.2	15	Fine Sand Over Bedrock
NA	1075103.697	1466608.221	757.04	sta 5 0+90	745.64	3.6	11.4	Fine Sand Over Bedrock
NA	107511824	1466610.068	756.74	sta 5 1+10	745.84	4.1	10.9	Fine Sand Over Bedrock
NA	1075133.857	1466605.643	756.97	sta 5 1+30eow	753.87	3.1	3.1	Fine Sand Over Bedrock
NA	1075140.302	1466602.109	758.05	sta 5 1+35tob	754.25	0	3.8	Fine Sand Over Bedrock
NA	1075171.887	1466698.498	765.09	sta 4 0+00tob	761.09	0	4	Fine Sand Over Bedrock

Attachment 1
Pre-Dredge Bedrock and Sediment Survey Results

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

NA	1075164.896	1466705.061	757.48	sta 4 0+10eow	756.48	3.5	1	Fine Sand Over Bedrock
NA	1075159.282	1466703.899	754.32	sta 4 0+30	752.82	6.8	1.5	Fine Sand Over Bedrock
NA	1075143.202	1466708.691	756.71	sta 4 0+50	749.51	4.3	7.2	Fine Sand Over Bedrock
NA	1075118.304	1466692.606	759.13	sta 4 0+70	744.83	2.7	14.3	Fine Sand Over Bedrock
NA	1075091.941	1466702.048	759.60	sta 4 0+90	745.10	1.2	14.5	Fine Sand Over Bedrock
NA	1075074.871	1466706.24	759.86	sta 4 1+10	747.46	1	12.4	Fine Sand Over Bedrock
NA	1075050.672	1466806.791	765.21	sta 3 0+00tob	749.41	0	15.8	Fine Sand Over Bedrock
NA	1075064.379	1466804.825	759.69	sta 3 0+10eow	748.59	1.2	11.1	Fine Sand Over Bedrock
NA	1075080.336	1466802.387	759.29	sta 3 0+30	746.49	1.6	12.8	Fine Sand Over Bedrock
NA	107510337	1466798.468	758.61	sta 3 0+50	747.51	2.3	11.1	Fine Sand Over Bedrock
NA	1075128.187	1466797.936	759.04	sta 3 0+70	747.44	1.7	11.6	Fine Sand Over Bedrock
NA	1075147.376	1466798.536	759.53	sta 3 0+90	747.93	1.4	11.6	Fine Sand Over Bedrock
NA	107516666	1466804.111	759.07	sta 3 1+10	747.97	1.8	11.1	Fine Sand Over Bedrock
NA	1075186.58	1466821.131	758.29	sta 3 1+20eow	753.89	2.4	4.4	Fine Sand Over Bedrock
NA	1075192.589	1466821.722	764.64	sta 3 1+30tob	757.34	0	7.3	Fine Sand Over Bedrock
NA	1075176.154	1466939.946	765.17	sta 2 0+00tob	755.17	0	10	Fine Sand Over Bedrock
NA	1075165.135	1466939.822	759.97	sta 2 0+10eow	752.17	0.9	7.8	Fine Sand Over Bedrock
NA	107514162	1466938.106	758.59	sta 2 0+30	749.39	1.3	9.2	Fine Sand Over Bedrock
NA	1075124.289	1466930.168	758.85	sta 2 0+50	751.45	2	7.4	Fine Sand Over Bedrock
NA	1075105.285	1466927.939	758.89	sta 2 0+70	751.59	2	7.3	Fine Sand Over Bedrock
NA	1075087.505	1466923.404	758.57	sta 2 0+90	751.57	2.3	7	Fine Sand Over Bedrock
NA	1075069.406	1466917.233	757.86	sta 2 1+10	751.86	3	6	Fine Sand Over Bedrock
NA	1075052.849	1466910.067	759.37	sta 2 1+20eow	751.87	1.6	7.5	Fine Sand Over Bedrock
NA	1075042.927	1466912.206	765.60	sta 2 1+25tob	751.80	0	13.8	Fine Sand Over Bedrock
NA	1075018.654	1466994.343	764.73	sta 1 0+00tob	749.23	0	15.5	Fine Sand Over Bedrock
NA	1075042.462	1467011.083	760.60	sta 1 0+20eow	749.90	0.3	10.7	Fine Sand Over Bedrock
NA	1075057.124	1467013.113	758.43	sta 1 0+40	749.93	2.4	8.5	Fine Sand Over Bedrock
NA	1075074.777	1467013.671	758.05	sta 1 0+60	750.25	2.8	7.8	Fine Sand Over Bedrock
NA	1075112.966	1467036.496	757.45	sta 1 1+00	750.45	3	7	Fine Sand Over Bedrock
NA	1075097.455	1467025.859	757.86	sta 1 0+80	751.76	3.4	6.1	Fine Sand Over Bedrock
NA	1075129.634	1467047.292	759.65	sta 1 1+20eow	758.35	1.2	1.3	Fine Sand Over Bedrock
NA	1075135.348	1467050.191	765.28	sta 1 1+30tob	761.18	0	4.1	Fine Sand Over Bedrock
NA	1075096.589	1467127.063	763.53	sta 0 0+00tob	761.33	0	2.2	Fine Sand Over Bedrock
NA	1075093.776	1467124.648	759.46	sta 0 0+05eow	759.46	1.1	0	Fine Sand Over Bedrock
NA	1075087.871	1467119.214	757.57	sta 0 0+10	756.57	6.6	1	Fine Sand Over Bedrock
NA	1075086.284	1467108.528	756.53	sta 0 0+30	750.33	4.3	6.2	Fine Sand Over Bedrock
NA	1075047.083	1467104.996	760.54	sta 0 0+50	750.54	0.3	10	Fine Sand Over Bedrock
NA	1075024.888	1467102.843	761.39	sta 0 0+70	751.39	0	10	Fine Sand Over Bedrock
NA	1074998.234	1467079.984	760.84	sta 0 0+90	749.54	0	11.3	Fine Sand Over Bedrock
NA	1074984.1	1467077.732	760.43	sta 0 1+00	750.43	0.5	10	Fine Sand Over Bedrock
NA	1074975.401	1467072.68	765.34	sta 0 1+10tob	750.14	0	15.2	Fine Sand Over Bedrock
NA	1074945.698	1467156.603	760.32	sta -60 0+10eow	745.02	0	15.3	Fine Sand Over Bedrock
NA	1074937.059	1467152.426	765.13	sta -60 0+00tob	754.93	0.6	10.2	Fine Sand Over Bedrock
NA	1074953.726	1467160.388	760.74	sta -60 0+20	750.54	0	10.2	Fine Sand Over Bedrock
NA	1074987.916	1467178.626	760.46	sta -60 0+50	753.66	0.4	6.8	Fine Sand Over Bedrock
NA	107500469	1467187.808	760.42	sta -60 0+70	753.32	0.4	7.1	Fine Sand Over Bedrock
NA	1075033.717	1467200.929	758.86	sta -60 0+90	752.26	2	6.6	Fine Sand Over Bedrock
NA	1075054.855	1467211.532	756.92	sta -60 1+10	752.92	4	4	Fine Sand Over Bedrock
NA	1075072.475	1467218.941	758.36	sta -60 1+30eow	757.26	2.6	1.1	Fine Sand Over Bedrock
NA	1075079.773	1467224.272	765.84	sta -60 1+40tob	762.74	0	3.1	Fine Sand Over Bedrock

Additional Probes

Shot Number	Northing	Easting	Elevation	Station ID	Bedrock Depth	Water depth	Probe Depth	Description
NA	1074862.547	1465716.849	761.39	STA 14 GND-01	750.39	0	11	Fine sand over Rock
NA	1074865.48	1465711.334	762.998	STA 14 GND-02	758.998	0	4	Fine sand over Rock
NA	1074928.282	1465802.692	762.11	STA 13 GND-03	742.11	0	20	Fine sand over Rock
NA	1074941.575	1465788.612	765.57	STA 13 GND-04	763.27	0	2.3	Fine sand over Rock
NA	1074987.144	1465903.39	762.77	STA 12 GND-05	742.77	0	20	Fine sand over Rock
NA	1075001.606	1465895.348	764.75	STA 12 GND-06	764.75	0	0	Rock

Bell's Beach Additional Probes

Shot Number	Easting	Northing	Elevation	Point ID	Bedrock Elev.	Water Depth	Probe Depth	Description
NA	1465185.76	1073827.71	724.64	Sta 28 gnd-01	717.64	0	7.00	Sand and silt over Bedrock
NA	1465180.23	1073854.53	725.78	Sta 28 gnd-02	720.58	0	5.20	Sand and silt over Bedrock
NA	1465066.77	1073823.21	724.38	Sta 29 gnd-03	713.68	0	10.70	Sand and silt over Bedrock
NA	1465058.33	1073848.68	722.75	Sta 29 gnd-04	719.45	0	3.30	Sand and silt over Bedrock
NA	1465269.28	1073807.30	723.95	Sta 27 gnd-05	718.95	0	5.00	Sand and silt over Bedrock
NA	1465269.72	1073827.12	725.03	Sta 27 gnd-06	721.83	0	3.20	Sand and silt over Bedrock
NA	1465404.00	1073877.61	727.24	Sta 26 gnd-07	724.74	0	2.50	Sand and silt over Bedrock
NA	1465388.45	1073886.10	726.94	Sta 26 gnd-08	725.44	0	1.50	Sand and silt over Bedrock

ARCADIS

Attachment 2

APPENDIX 2

AIR TEST DATA SHEET

Owner (Name of city, district, etc.) Schlumberger Test No. 03

Identification of Pipe Installation (Job name, location, contract number, etc.) 12 Mile Creek Restoration Project, 198 Old Henderson Rd, Central, SC

Field Test Data: (To be filled in by the Inspector)

Date: 11 March 2010 Specified Maximum Pressure Drop: 1 psig

Identification of Pipe Material Installed 18" SDR-17 HDPE

Pipe Under Test				Spec. Time	Field Test Operations Data					
Upstream MH sta #	Downstream MH sta #	Dia. D (in.)	Length L (ft.)	Refer to UNI-B-6. (min:sec)	Pressure Initially Raised to (psig)	Time Allowed for Pressure to Stabilize (min)	Start Test Pressure (psig)	Stop Test Pressure (psig)	Elapsed Time (min:sec)	Pass or Fail (P or F)
N/A	N/A	18"	1,433	-	30	18	30	30	38:12	P

Inspector's Name and Title: Terry Lambert / Site Manager

Signature of Inspector: Terry Lambert

If a section fails, the following items should be completed:

Identify section(s) that failed _____

Leak (was) (was not) located. Method used: _____

Description of leakage found: _____

Description of corrective action taken: _____

For test results after repair refer to Test No. _____, Inspector _____

This data sheet may be used in conjunction with Recommended Practice UNI-B-6. The Uni-Bell PVC Pipe Association is interested in evaluating the testing of sewer pipe installations with low-pressure air. The purpose of this "Air Test Data Sheet" is to assist in obtaining information from field testing of sewer pipes as well as to assist the community in evaluating the sewer's acceptability.

Copies of the above "Air Test Data Sheet" are available free of charge upon request from Uni-Bell. The Uni-Bell PVC Pipe Association suggests that one copy of the completed sheet be retained for your files and requests that one copy be sent to: Uni-Bell PVC Pipe Association, 2655 Villa Creek Drive, Suite 155, Dallas, TX 75234.

COUNTY OF PICKENS

www.co.pickens.sc.us

Office of Stormwater Management

February 23, 2010

Lance S. Ketcham, P.E.
Senior Engineer/Manager
ARCADIS, U.S., Inc
6723 Towpath Road
P.O. Box 66
Syracuse, New York
13214-0066

Re: Twelve Mile Creek Restoration Project
Addendum to SWPPP for Work Near Creek (final submission February 17, 2010)
Pickens County File # 39-18-09

The addendum to the site plan approved November 2009, for the referenced project, is approved under the guidelines of the Pickens County Stormwater Program. Please provide five copies of the plan for processing. A copy will be retained in the Engineering office, the Stormwater office, and 3 copies will be returned for your distribution, one of which should remain on site at all times. This approval allows storm water discharges associated with construction activity to discharge to waters of the State and South Carolina in accordance with provisions of the S.C. Pollution Control Act. Permits and/or approvals from other federal, state or local agencies may be required to comply with NPDES and other applicable laws. Please check with your consultant to ensure that you have all necessary permits and/or approvals for this project.

This approval is only applicable for the plans submitted for this project. Additional construction or land disturbing activities beyond the scope of these plans is not authorized and will require submittal of another site plan.

Pickens County and/or the SCDHEC EQC District office will conduct periodic inspections of this project. Failure to comply with the approved site plan, the requirements of SC Regulation 72-300, the SC Stormwater Management and Sediment Reduction Act, or the Pickens County Stormwater Ordinance may subject you to applicable penalties.

If you have any questions, please call me at (864) 898-5789.

Sincerely,

Scottie Ferguson
Pickens County Stormwater Manager

cc via email: Jill Stewart - SCDHEC
Chuck Williams - SCDHEC
Lance Ketcham - ARCADIS
Du'Bois Ferguson -
Gary Odom
Kim Veal

222 McDaniel Avenue, B-21 . Pickens, South Carolina 29671 . Telephone (864) 898-5789 . Fax (864) 898-5580

D H E C
PROMOTE PROTECT PROSPER

March 11, 2010

Du'Bois (Joe) Ferguson
300 Schlumberger Drive
Rm 263
SugarLand, Texas 77478

Re: Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site
Twelvemile Creek Restoration Project Sediment Management Unit (SMU)
Pickens County
SCS 123456847

Dear Mr. Ferguson,

The South Carolina Department of Health and Environmental Control has completed its review of documents related to the construction and operation of the proposed Sediment Management Unit (SMU) and associated wastewater treatment systems at the referenced site. In June 1994, a CERCLA Record of Decision was signed for the Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Operable Unit Two Superfund Site. Subsequently, in September 2009, an Explanation of Significant Difference was signed incorporating into the selected remedy all activities necessary to facilitate Woodside 1 and Woodside 2 dam and sediment removal activities. As a result of these actions, construction and operation of the SMU and associated facilities is being performed under CERCLA.

This letter contains memorandums from Mr. Kent Coleman with the Bureau of Land and Waste Management's Division of Mining and Solid Waste Permitting, and from Mr. Jeff DeBessonet with the Bureau of Water's Division of Water Facilities Permitting. These two memorandums constitute approval that the appropriate technical standards have been satisfied with regard to construction and operation of the SMU and associated wastewater treatment facilities. Copies of the memorandums are provided as an attachment to this letter.

Please be advised that the attached approvals contain additional requirements which must be satisfied as outlined in the approvals. If you should need any further information, please do not hesitate to contact Mr. Van Keisler at (803)896-4014.

BLWM file # 50901

Sincerely,

G. Kendall Taylor, P.G., Director
Division of Site Assessment, Remediation and Revitalization
Bureau of Land and Waste Management

Attachment (2)

Cc: Leon C. Harmon Esq. (Nexsen Pruet)
Honorable William W. Wilkins, (Nexsen Pruet)
Lance Ketchum, ARCADIS
Paul Doody, ARCADIS
Craig Zeller, EPA Region IV
Ross Self, SCDNR
Daphne Neel, BLWM
Kent Coleman, BLWM
Jeff DeBessonet, BOW
Susan Turner, EQC Region 2 Greenville

MEMORANDUM

TO: G. Kendall Taylor, P.G., Director
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management

FROM: Kent M. Coleman, P.G., Director KMC
Division of Mining and Solid Waste Management
Bureau of Land and Waste Management

DATE: March 11, 2010

SUBJECT: Twelvemile Creek Restoration Project Sediment Management Unit (SMU)
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site
Location: 34°46'29" N, 82°46'56" W
Pickens County

References:
1. *Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site – Twelvemile Creek Restoration Final Design Report* (ARCADIS), August 2009 (with revisions dated 10/12/2009 and 11/5/2009);

2. *Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site – Twelvemile Creek Restoration Closure and Post-Closure Care Plan* (ARCADIS), March 2010;

3. *Twelvemile Creek Restoration Project Fill Progression Plan* (Weston/Schlumberger/ARCADIS), Revision 1, 3/1/2010;

4. *Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site – Twelvemile Creek Restoration Groundwater Monitoring Plan* (ARCADIS), March 2010;

5. *Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site – Twelvemile Creek Restoration Liner Certification Data Report* (ARCADIS), March 2010;

6. Letter, Coleman (DHEC) to Ferguson (Schlumberger), December 18, 2009.

The Division of Mining and Solid Waste Management (DMSWM) has reviewed the above-referenced documents for compliance with the requirements for Class 3 Landfills found in S.C. Regulation 61-107.19, *Solid Waste Landfills and Structural Fill*, and has determined that the requirements of this regulation are satisfied. Construction of the Sediment Management Unit in accordance with the Final Design Report (Reference 1) was approved on December 18, 2009, by letter from the Department to the Schlumberger Corporation (Reference 6).

At this time, the DMSWM is satisfied that the construction of the SMU to date has been completed in accordance with the approved design drawings and specifications contained in Reference 1, as confirmed by the manufacturing quality assurance and construction quality assurance (MQA/CQA) documents contained in Reference 5 and the Department's inspection of March 3, 2010. Therefore, it is the recommendation of the DMSWM that disposal operations be allowed to commence with the following conditions:

1. The start of disposal operations at the SMU shall not begin until the Department receives a financial assurance mechanism (or mechanisms) in the amount of the approved Closure/Post-Closure Care Cost Estimates. The Department-approved estimates for Closure and Post-Closure Care are $1.7 million and $2.8 million, respectively. The financial assurance mechanism (or mechanisms) must be one of the approved types listed in Part I of Regulation 61-107.19 and must be in a format that is satisfactory to the Department for it to be accepted.

2. The DMSWM considers 1) dredged inorganic sediment and 2) demolition debris from demolition of the two (2) dams and ancillary structures as the only approved material for disposal into the SMU. Significant amounts of organic material (e.g. tree trunks, limbs, plant material) and miscellaneous garbage (e.g. tires, appliances, bottles, cans, etc.) are to be disposed elsewhere (i.e. off-site) at an appropriate facility.

3. The liner protective layer (i.e., the initial two (2) feet of sediment) shall consist of dredged sediment conforming to the requirements found in Part 2, Section H of Specification 17501 in Reference 1. Construction Quality Assurance on the protective layer shall include thickness tests at a minimum rate of 4 tests per acre, and additional testing as specified in Part 2, Section H of Specification 17501. Immediately following completion of the protective layer, the Department must review and approve all CQA documentation prior to placement of any additional sediment or demolition debris. Placement of the protective layer in the area of the equalization basin in Grid #3 may be postponed until such time as the equalization basin is no longer needed. At that time, placement of the protective layer shall commence and the same CQA practices shall apply.

4. The DMSWM requires that revised drawings depicting the final cover consistent with the Closure/Post-Closure Care Plan (Reference 2) be submitted to the Department within two (2) weeks of the Department's approval to begin disposal operations. Drawings G-407 and G-411 of the Final Design Report are affected by this requirement.

5. The DMSWM requires that a request for a Monitoring Well Approval be submitted to the Department within two (2) weeks of the Department's approval to begin disposal operations. Drilling activities must commence within two (2) weeks of the Department's issuance of the Monitoring Well Approval, and all monitoring wells must be installed within ninety (90) days of the Department's issuance of the Monitoring Well Approval.

The DMSWM is willing to assist as needed with the review of any future submittals (e.g. design changes, progress reports, analytical data, etc). Please contact John M. McCain of my staff at (803) 896-4067 if you have any questions.

KMC/JMM/jmm

cc: Keith Collinsworth, P.G., Manager – BLWM, Solid Waste Groundwater Section
Van Keisler, P.G., Manager – BLWM, Federal Remediation Section
Marty Lindler, Manager – BLWM, Solid and Hazardous Waste Compliance Section
Joan Litton, Manager – BLWM, Solid Waste Permitting Section
Bill Rampey – BES, Region 2 EQC, Greenville office
Bureau File # 50903

D H E C

PROMOTE PROTECT PROSPER

BUREAU OF WATER
MEMORANDUM

March 11, 2010

To: Ken Taylor, Director
Site Assessment, Remediation & Revitalization Division

From: Jeffrey P. deBessonet, P.E., Director
Water Facilities Permitting Division

RE: SANGAMO WESTON (SCHLUMBERGER)/PICKENS/TWELVE-MILE CREEK RESTORATION PROJECT WWTF
Pickens County

Attached is approval for the as-built construction and operation of the wastewater treatment system for the Twelve Mile Creek Restoration Project.

This facility is required to have an operator-in-charge who has been certified by the Environmental Certification Board of the South Carolina Department of Labor, Licensing and Regulation. This facility has been classified as Group **II-Physical/Chemical**, necessitating an operator holding a Grade **C-Physical/Chemical** or higher certificate. Questions regarding operator certifications should be directed to Ms. Dona Ferguson, South Carolina Environmental Certification Board, P.O. Box 11409 Columbia, SC 29211, (803) 896-4430.

The Environmental Quality Control (EQC) Regional Office contact is Eric K Kim in the Greenville EQC Office. This regional office may be contacted at the following address and phone number: 301 University Ridge Ste 5800, Greenville, SC 29601-4703, 864-241-1090.

cc via email: Melinda G. Vickers, BOW
Dale Stoudemire, BOW

Bureau of Water

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Permission is Hereby Granted To: **SCHLUMBERGER TECHNOLOGY CORPORATION**
538 Sangamo Rd
Pickens SC 29671

for the as-built construction and operation of a wastewater treatment plant in accordance with the construction plans, specifications, and engineering report signed by Kimberly S. Veal, Registered Professional Engineer, S.C. Registration Number: 18398.

PROJECT DESCRIPTION: This project consists of the following components: 4-21,000 gallon each presettling frac tanks, a one 539,958 gallon modular settling/clarification tank with 60 mil polyethylene liner, 5- 1100 gpm (4 active, one spare) centrifugal process pumps, 5 treatment trains each consisting of 4-1000 gpm multi-media sand filters, 6-1000 gpm 75 psi carbon vessels, 4-1000 gpm 100 psi carbon vessels, 5 bag filter housing units with 8 bag filters each, 2-500 kW generators (main and backup), 5 in-line flow meters with totalizers (flow will be summed for reporting), 25 yd sludge holding tank, 260 gpm diaphragm sludge pump, a 1433 LF 18" HDPE effluent force main line with sampling port, and associated piping and appurtenances.

The effluent will be discharged to Twelve Mile Creek at a daily average rate of 5760000 gallons per day.

The effluent concentrations of those constituents the wastewater treatment system is designed to remove or reduce are contained in approval letter dated October 15, 2009 from Butch Swygert (DHEC) to Chris Moody (ARCADIS).

TREATMENT PLANT CLASSIFICATION: Group II-Physical/Chemical

CONDITIONS:

1. Sediment and other wastewater treatment solids shall be disposed in the onsite Sediment Management Unit (SMU) approved per the requirements of the Bureau of Land and Waste Management.

2. The permittee shall provide for the performance of daily treatment facility inspections by a certified operator of the appropriate grade. Attendance by the certified operator of the appropriate grade is required only on days when treatment occurs; therefore, Sundays may be excluded from the daily inspection when the system is not operating. The inspections shall include, but should not necessarily be limited to, areas which require visual observation to determine efficient operation and for which immediate corrective measures can be taken using the O & M manual as a guide. All inspections shall be recorded and shall include the date, time, and name of the person making the inspection, corrective measures taken, and routine equipment maintenance, repair, or replacement performed. The permittee shall maintain all records of inspections at the permitted facility as required by the permit, and the records shall be made available for on-site review during normal working hours.

3. The permittee shall maintain at the permitted facility a complete Operations and Maintenance (O&M) Manual for the wastewater treatment system. The manual shall be made available for on-site review during normal working hours. The manual shall contain operation and maintenance instructions for all equipment and appurtenances associated with the wastewater treatment system. The manual shall contain a general description of the treatment process(es), operating characteristics that will produce maximum treatment efficiency and corrective action to be taken should operating difficulties be encountered.

4. In accordance with Regulation 61-67, Standards for Wastewater Facility Construction, all wastewater treatment facilities shall be closed out within one hundred eighty (180) days when the facility is closed or the effluent disposal permit is inactivated, terminated or revoked, unless otherwise determined by the Department. Closure of wastewater treatment facilities necessitates the submittal of a closure plan and approval of the plan by the Department in accordance with R.61-82 prior to closure of any wastewater treatment unit(s).

5. This condition revises Special Condition #9 of the October 15, 2009 letter from Butch Swygert to Chris Moody approving the discharge to the river to allow for an alternate sampling day.

   The permittee shall monitor all parameters consistent with conditions established by this permit on the 1st Tuesday of every calendar month in which sampling is required, unless otherwise approved by this Department. If this day falls on a holiday, sampling shall be conducted on the next business day. If no discharge occurs on this day, the permittee shall collect an effluent sample during the reporting period on a day when there is a discharge or report "no discharge" for the reporting period for all parameters. Additional monitoring as necessary to meet the frequency requirements of this permit shall be performed by the permittee.

6. The results of effluent sampling shall be submitted to the Department at the address below. The results shall be summarized in tabular form by sample date, parameter and sample result. The submittal shall reference the project name and the October 15, 2009 approval letter for the discharge.

   S.C. Department of Health and Environmental Control
   Bureau of Water/Water Pollution Control Division
   Data Management Section
   2600 Bull Street
   Columbia, South Carolina 29201

ARCADIS

Infrastructure, environment, buildings

Imagine the result

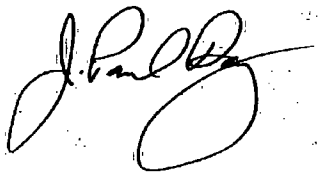
Schlumberger Technology Corporation

Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site – Twelvemile Creek Restoration

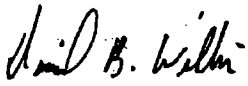
Groundwater Monitoring Plan

March 2010

ARCADIS



John Paul Doody, P.E.
South Carolina P.E. #26698



David B. Willis, South Carolina P.G. #508
Project Geologist

Groundwater Monitoring Plan

Prepared for:
Schlumberger Technology Corporation

Prepared by:
ARCADIS
6723 Towpath Road
P.O. Box 66
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.0017
Local Office:
ARCADIS
30 Patewood Drive, Suite 155
Greenville
SC 29615

Our Ref.:
MT001019.0001

Date:
March 2010

Appendices

1. Introduction

ARCADIS was retained by Schlumberger Technology Corporation to prepare this Groundwater Detection Monitoring Plan for the Sangamo Weston/Twelvemile Creek/ Lake Hartwell PCB Contamination Superfund Site in Pickens County, South Carolina. The area of interest relative to groundwater monitoring is composed of one Sediment Management Unit (SMU) cell, which is scheduled to be closed in 2010. This Plan is being submitted to the South Carolina Department of Health and Environmental Control (DHEC) to satisfy the requirements set forth in South Carolina Solid Waste Regulation R.61-107.19 Part V.E.

2. Site Description

2.1 Location

The SMU is located off Old Henderson Road, approximately 2.5 miles north of the Town of Norris, South Carolina (Figure 1). The SMU is situated on an approximately 40-acre tract of land located in a rural setting. Figure 2 depicts the current layout of the SMU and illustrates the previous boring locations within the SMU and the proposed well locations to be installed at the site.

2.2 Site Topography

The local topography is characterized by a ridge bounded by a gradual slope toward the Twelvemile Creek with a small tributary (Camp Creek) to the west of the SMU. The approximate elevations within the SMU area ranges from 940 to 750 feet above mean sea level (AMSL). Surface water drainage from the SMU will be conveyed by a series of small constructed ditches to storm water basins located on the east, west and south side of the SMU.

2.3 Site Geology

The SMU is located on unconsolidated, fine to coarse grain quartzitic sands and reddish brown silts and clays termed saprolite and recent alluvium in stream beds. Based on temporary borings, the saprolite ranges from approximately 57 feet thick to 37 feet thick within the SMU. Below the saprolite lies bedrock ranging from 817.6' AMSL at the southern end of the SMU up to 886.9' AMSL. The bedrock below the SMU is part of the Six mile Thrust Sheet research indicates it is composed of the metamorphic rock, gneiss.

2.4 Site Hydrogeology

Groundwater within the SMU area was not encountered during the site characterization to bedrock. Typical for the Piedmont, the saprolite above bedrock yielded no perched water and therefore groundwater elevations in the bedrock are still to be evaluated.

2.5 Groundwater Flow

Based on the site topography, the top of the ridge is probably a groundwater divide with groundwater discharge to both Twelve Mile Creek and Camp Creek. Since water

levels within the bedrock have yet to be established at the site a conclusive flow direction has yet to be established.

3. Monitoring Network

3.1 Proposed Monitoring Wells

It is proposed to install five bedrock wells surrounding the SMU (one on each of the N/SE/SW/E and W sides) in order to establish groundwater elevation and meet the substantive requirements of R.61-107.19 Part V.E.258.53.d. The overall approach for locating the proposed wells was discussed with DHEC at the preliminary design meeting on October 2, 2009 and installation will commence upon approval of this Groundwater Monitoring Plan. The monitoring well network will consist of five wells, as described below and as located on Figure 2. Initiation of well installation is anticipated to commence within one month after approval of this Groundwater Monitoring Plan. Once installed, the monitoring well network will consist of a sufficient number of wells, installed at appropriate locations and depths to yield representative groundwater samples and water level elevations to determine if a release has occurred from the landfill as required by R.61-107.19 Part V.E.258.51.a.

The five proposed monitoring wells will be screened within the water table and utilize screen settings determined by the field geologist. The North monitoring well will be located up gradient of the SMU and provide an indication of background groundwater quality. Monitoring wells SE/SW/E and West will evaluate the edges of the approximate groundwater flow down gradient of the SMU and provide compliance monitoring points to address potential groundwater flow in that direction. The actual spacing and depths of the monitoring wells will be based upon site-specific geologic and hydrogeologic conditions as required by R.61-107.19 Part V.E.258.51.d.

Monitoring wells at the SMU will be constructed in accordance with DHEC standards (i.e., R.61-71.H) and will be installed at locations and depths that ensure adherence to the requirements of R.61-107.19 Part V.E.258.51.a. and R.61-107.19 Part V.E.258.51.d. Per Departmental request and in order to satisfy R.61-107.19 Part V.E.258.51.d., monitoring wells will be installed as open hole bedrock wells in the fractured bedrock. A pilot hole will be drilled to the top of bedrock and surface casing will be grouted five feet into the bedrock. The inner borehole will be advanced with an air hammer drill until sufficient water is observed in the returns. In addition, each well will be properly labeled with a permanent identification plate constructed of a durable material secured to the well casing or surface pad where it will be readily visible. The proposed bedrock well construction diagram is illustrated on Figure 3 and proposed technical specifications for installation provided in Appendix B. After installation, the locations of the new monitoring wells will be surveyed by a South Carolina Certified

Land Surveyor and the ground surface and top of well casing elevations will be recorded to the nearest 0.01 foot AMSL.

3.2 Proposed Surface Water Sampling Point

Tentative surface water sampling locations downgradient of the SMU will be reviewed for seeps and sampled if necessary (note 5 on Figure 2). If more than a single seep is encountered, the samples will be composited for analysis for the same list of constituents as the groundwater monitoring wells. The locations are tentative, since prior investigation activities did not identify specific seeps. If during the semi-annual sampling events a permanent seep is located, the seep will be included on the map and sampled at the same frequency as the monitoring wells. Seeps that may be intermittent will not be added to the Plan.

3.3 Implementation Schedule

Upon approval of the Groundwater Monitoring Plan, monitoring well installation will be scheduled within approximately two weeks. After installation, the wells will be developed and sampled for baseline data. During this and future sampling events, the soil/bedrock interface will be walked downgradient of the SMU for possible seeps and sampled as necessary.

4. Sampling and Analysis Plan

The following sampling and analysis plan outlines the procedures and protocols to be utilized for monitoring groundwater at the SMU, and has been developed in accordance with the requirements set forth in the DHEC landfill regulation R.61-107.19 Part V.E.258.53 e for a Class 3 landfill. The groundwater monitoring program for the SMU includes consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells. Procedures and techniques for the following are included in this sampling and analysis plan:

- Sample collection
- Sample preservation and shipment
- Analytical procedures
- Chain of custody control
- Quality assurance and quality control (QA/QC)

4.1 Sample Collection

Sampling procedures will be performed at the SMU by personnel trained in groundwater monitoring methods and procedures. The first samples will be collected upon completion of the well installation and will serve as baseline samples. Upon arrival at the site and prior to purging, the total well depth and depth to groundwater will be measured in each of the wells to the nearest + 0.01 foot using a water level meter. The water level meter will be decontaminated using a phosphate-free detergent and rinsed with tap water followed by de-ionized water between each water level measurement in accordance with EPA Region 4 Field Branches Quality System and Technical Procedures, Science and Ecosystem Support Division (SESD) procedure SESDPROC-205-R1 "Field Equipment Cleaning and Decontamination" (11/1/2007 revisions). The depth to groundwater measurements will be collected on the same day to avoid temporal variations in groundwater elevations that could preclude an accurate determination of groundwater flow rate and direction. Groundwater elevations at each of the wells will be determined by subtracting the depth to water measurement from the top of casing elevation. A groundwater potentiometric surface map will be generated using the groundwater elevation data collected during each sampling event.

Groundwater sampling at each well will begin by calculating the volume of water present in the well casing using the depth to water and total well depth measurements. The monitoring wells will be purged and sampled using a decontaminated bladder pump or peristaltic pump and clean, disposable tubing. The wells will be purged in accordance with the low-flow/low stress method set forth in EPA SESD procedure SESDPROC-301-R1 "Groundwater Sampling" (11/1/2007 revisions), utilizing a pumping rate of 500 to100 mL/min. Field parameters including temperature, pH, specific conductance, turbidity, oxidation-reduction potential, and depth to groundwater will be monitored and recorded on field forms during the low-flow purge activities. Per SESDPROC-301-R1, an adequate purge is achieved when the pH, specific conductance, and temperature of the ground water have stabilized and the turbidity has either stabilized or is below 10 nephelometric turbidity units (NTUs). Stabilization occurs when, for at least three consecutive measurements, the pH remains constant within 0.1 Standard Unit (SU); specific conductance varies no more than approximately 10 percent and the temperature is within 1 degree. The well will be sampled after the field parameters have stabilized.

New nitrile gloves will be worn during the sampling activities at each sampling location. Consistent with proper sampling methods, sample containers at each well will be filled in order of volatilization sensitivity (i.e., polychlorinated biphenyls [PCBs] will be collected prior to metals, and at a maximum rate of 100 milliliters per minute). Groundwater samples will not be field filtered prior to laboratory analysis. The groundwater samples will be placed in appropriately preserved, laboratory supplied containers; properly labeled; placed on ice; and submitted to a laboratory certified by South Carolina under R.61-81 State Environmental Laboratory Certification Program for the sample preparations and analysis methods employed.

The sampling protocol for seeps that may be identified will need to be established based on field conditions encountered at the time seeps are identified. At this time it is anticipated that a grab sample would be collected with laboratory supplied containers.

4.2 Sample Preservation and Shipment

All sample containers will be appropriately preserved by the contracted DHEC certified laboratory in accordance with their QA/QC program prior to delivery. Sample containers will be labeled with a self-adhesive label listing the facility name, sample ID, sample collector, date and time of collection, preservative, and requested analysis. Immediately after collection, the sample bottles will be placed on ice in order to lower the temperature to at least four degrees Celsius.

The samples will be delivered to the DHEC certified laboratory as soon as possible, either by direct delivery to the laboratory/laboratory courier or via a third party parcel delivery service capable of overnight delivery. A sufficient amount of ice shall be placed in the sample cooler to maintain a temperature at or below four degrees Celsius until delivery.

4.3 Analytical Procedures

Groundwater samples collected from the monitoring wells and surface water samples (if surface water seeps are identified) will be analyzed for the metals and PCBs in Table 1 and detailed in Appendix A. This list of parameters satisfies the requirements set forth R.61-107.19 Part V.E.258.54.a.1., stating that any of the monitoring parameters listed in Appendix IV for a Class Three landfill can deleted if the constituent(s) are not reasonably expected to be contained in or derived from the waste contained in the landfill. Since the SMU will only contain sediments from Twelvemile Creek, which contain PCBs, the analyte list has been reduced to PCBs and metals.

4.4 Chain of Custody Control

After sample collection is complete, the necessary Chain of Custody information will be documented. This information will include but not be limited to the sample ID, date and time of sample collection, sample collector, sample media, analyses requested, and the number of bottles and types of preservatives used. Chain of Custody documentation will be kept on all samples to ensure sample integrity is maintained. This documentation will begin in the field and follow through to the destruction of the sample. The purpose of the procedure is to ensure that the sample has been in possession of, or secured by, a responsible person at all times.

4.5 Quality Assurance and Quality Control

Field QA/QC procedures include all those activities performed to ensure that contamination of samples does not occur during sampling. All sample containers will be provided by the laboratory and will remain in airtight containers until they are to be used to collect samples. All field equipment will be placed on clean plastic sheets to prevent contact with the ground surface. Clean, new 3/8" polyethylene tubing will be used at each well for collecting samples. New nitrile gloves will be worn for each sampling activity.

All meters will be calibrated according to the specifications of the individual meter. Standards used to calibrate for pH and specific conductance will bracket the average values for each parameter. Meters and non-dedicated equipment will be decontaminated following the procedures set forth in SESDPROC-205-R1.

A field blank or equipment blank will be collected once per sampling event and sampled when non-dedicated equipment that comes into direct contact with the groundwater (e.g., a submersible pump) is used. The equipment blank will be analyzed for the full suite of analyses run at that location.

5. Frequency of Monitoring and Reporting Schedule

As required by R.61-107.19 Part V.E.2.58.54.b., the five monitoring wells will be sampled on a quarterly basis for the first year and will be sampled on a semi-annual basis thereafter, following closure of the SMU. The frequency will be assessed every year and modified if appropriate based on the findings from the preceding four sampling periods. The four quarterly sampling events will be scheduled approximately three months apart for the first year. Thereafter semi-annual sampling will be scheduled approximately six months apart.

5.1 Semi-Annual Data Submittal

A Data Submittal, presenting the information obtained during each sampling event, will be submitted to DHEC and EPA 45 days following data validation. This data will include; field data sheets presenting the field measurements and monitoring well conditions recorded during the sampling event, the laboratory Certificates of Analysis, the laboratory QA/QC documentation, and copies of the Chain of Custody forms. Note that this report will be submitted quarterly for the first year, and semi-annually thereafter unless the sampling frequency changes.

5.2 Annual Report

An annual Report of Groundwater Conditions will be submitted to DHEC and EPA following the completion of sampling events for that particular year. The annual report will include the field data sheets, Certificates of Analysis, the laboratory QA/QC documentation, and Chain of Custody forms from the sampling events and will present a summation of the sampling activities and results from the previous year. Additionally, the annual report will provide groundwater elevation data, a determination of groundwater flow direction and rate (based upon interpretation of potentiometric maps prepared utilizing the groundwater elevations measured during the sampling events), and a determination of the technical sufficiency of the monitoring well network in detecting a release from the facility. The evaluation of the statistical analysis for the previous events will be included in the annual report along with any recommendations for modifying the program moving forward. In addition, any repairs or replacement of wells will be documented, if they were necessary or are recommended.

6. Revisions

Revisions to this Groundwater Monitoring Plan will be made as necessary, and the basis for such changes would be provided in the annual reports. Revised plans will be submitted to SC DHEC for approval prior to implementation of any changes. Events that may call for plan revisions include but are not limited to, the following:

- Point of compliance changes due to changes in groundwater flow
- Addition of new monitoring wells
- Abandonment of existing wells

Tables

Table 1
Summary of Analyses at Site Monitoring Wells

Groundwater Monitoring Plan
Sangamo Weston/ Twelvemile Creek/ Lake Hartwell PCB Contamination Superfund Site - Twelvemile Creek Restoration

Schlumberger Technology Corporation

Monitoring Well ID	Metals and Total PCBs (Parameters 1 & 2)
MW-1	X
MW-2	X
MW-3	X
MW-4	X
MW-5	X

Notes:

1. List of Parameters from February 3, 2010 DHEC comment letter on Sangamo Weston/Twelve Mile Creek Groundwater Monitoring Plan
2. Metals (Inorganics: USEPA Method 6010B) + Total PCBs (USEPA Method 8082)

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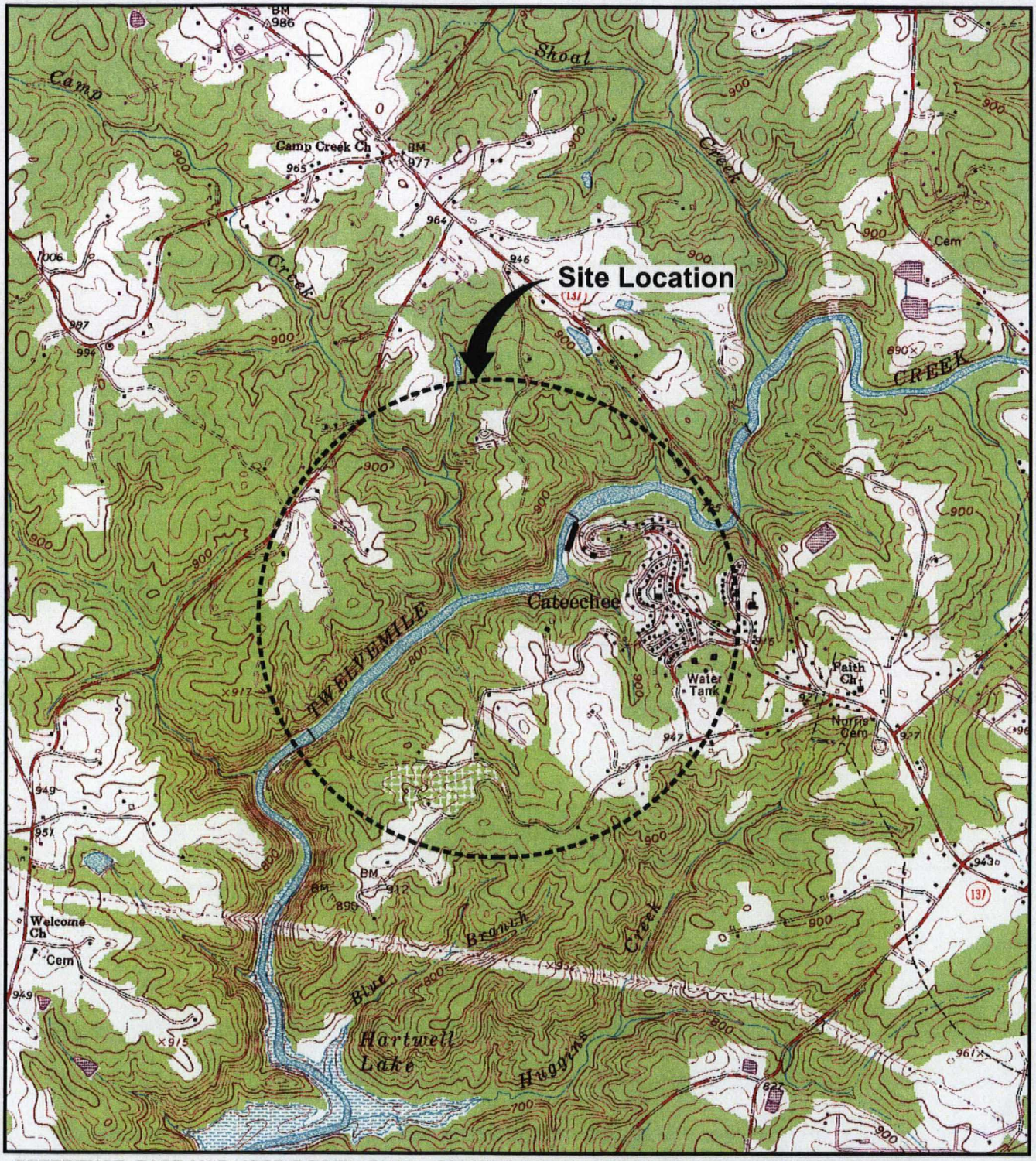
Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., SIX MILE, SOUTH CAROLINA 1961, PHOTOREVISED 1980.

2000' 0 2000'

Approximate Scale: 1" = 2000'

SCHLUMBERGER TECHNOLOGY CORPORATION
PICKENS COUNTY, SOUTH CAROLINA

TWELVEMILE CREEK RESTORATION GROUNDWATER MONITORING PLAN

SITE LOCATION MAP

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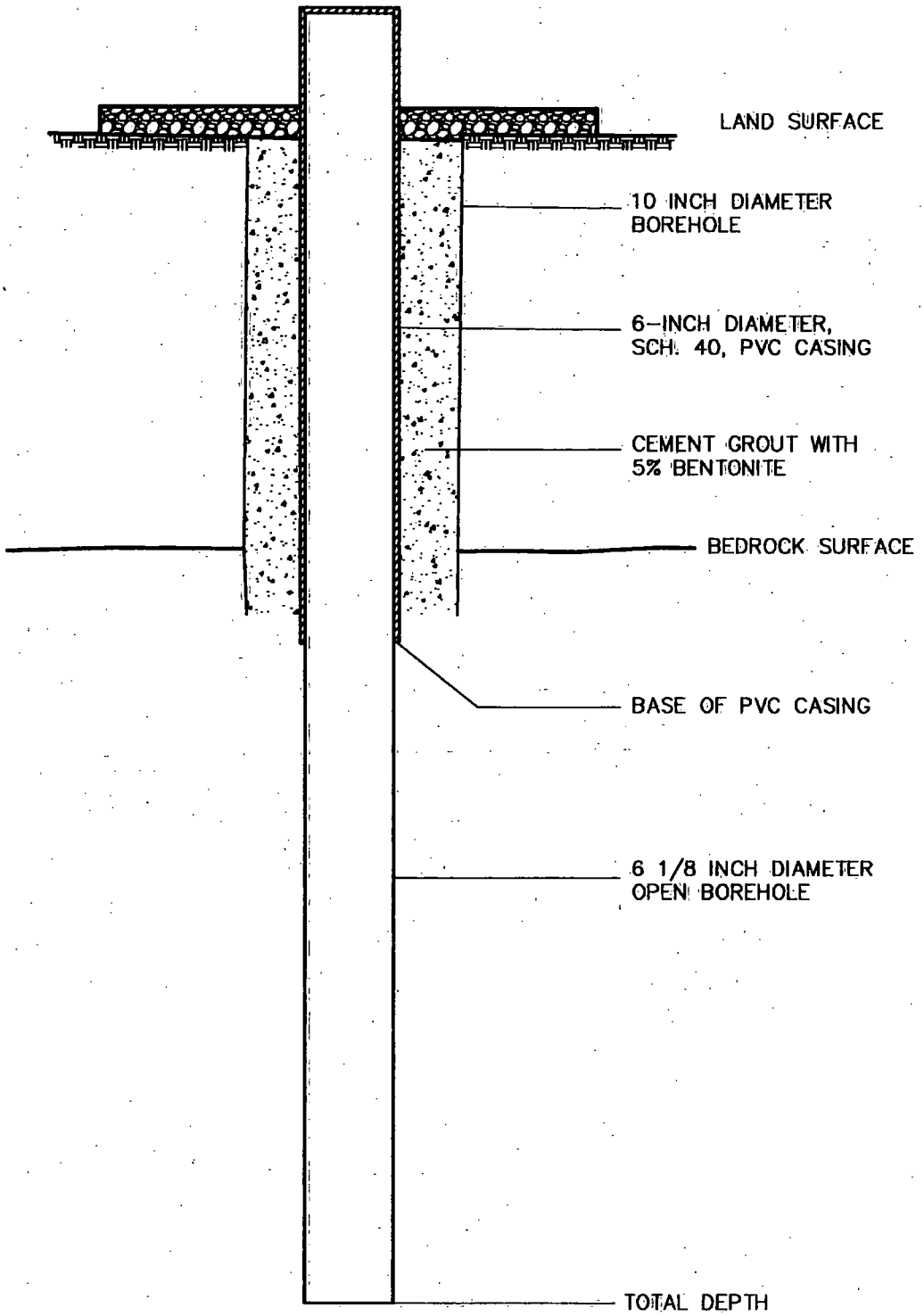
FIGURE
1

03/09/2010 SYRACUSE, NY-ENV/CAD-141 K.SARTORI L.POSENAUER
MT001019/0001/00014/CDR/01019N02.CDR



NOT TO SCALE

SCHLUMBERGER TECHNOLOGY CORPORATION
PICKENS COUNTY, SOUTH CAROLINA
TWELVEMILE CREEK RESTORATION GROUNDWATER MONITORING PLAN

BEDROCK WELL CONSTRUCTION DIAGRAM

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FIGURE
3

Appendices

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Appendix A

List of Parameters for Groundwater Monitoring at the Twelvemile Creek Sediment Management Unit

Appendix A
List of Parameters for Groundwater Monitoring at the Twelvemile Creek Sediment Management Unit

Common Name	CAS RN
pH	
Specific Conductance	
Inorganic Constituents:	
Antimony Total	7440-36-0
Arsenic Total	7440-38-2
Barium Total	7440-39-3
Beryllium Total	7440-41-7
Cadmium Total	7440-43-9
Chromium Total	7440-47-3
Cobalt Total	7440-48-4
Copper Total	7440-50-8
Lead Total	7439-92-1
Nickel Total	7440-02-0
Selenium Total	7782-49-2
Silver Total	7440-22-4
Thallium Total	7440-28-0
Vanadium Total	7440-62-2
Zinc Total	7440-66-6
Polychlorinated biphenyls; PCBs:	1336-36-3
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5

Notes:
For monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5
[2] Metals (Inorganics: USEPA Method 6010B) + Total PCBs (USEPA Method 8082)
Data from: DHEC, Regulation 61-107.19, SWM: Solid Waste Landfills and, Structural Fill
Effective Date: May 23, 2008

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Appendix B

Technical Specifications, Five Bedrock Monitoring Wells at Twelvemile Creek Sediment Management Unit

Technical Specifications
Five Bedrock Monitoring Wells at Twelvemile Creek
Sediment Management Unit

1. SCOPE: The work consists of the installation of five open hole bedrock monitoring wells at the SMU. The monitoring wells will be installed using air rotary methods.

   It is the duty of the drilling contractor to assure that all monitoring well installation activities conform to South Carolina Well Standards (R61-71) and that the well is installed by a South Carolina certified driller.

2. PERSONNEL: The Driller, in addition to furnishing the services of skilled, experienced, and licensed drillers, shall also furnish an adequate number of experienced, competent helpers. The Drillers shall be capable of keeping good well logs and reports of the drilling, developing, and test-pumping operations as instructed.

3. HOURS: Work will be performed not less than 10 hours per day, 5 days per week, nor more than 12 hours per day, 6 days per week. During well completion (casing installation, gravel packing, grouting), work will be performed on an around-the clock basis until the hole is completed unless otherwise instructed by the Consultant.

4. PERMITS: South Carolina Department of Health and Environmental Control approval to drill the required wells will be the responsibility of ARCADIS.

5. CEMENT SPECIFICATIONS: Cement mixtures will consist of Class A, type 1 Portland cement with 3 percent beneficiated sodium bentonite by volume. The specific mixture to be used will be directed by the Consultant's on-site representative but will generally be as follows: approximately 2 cups of bentonite, 8.5 gallons water per 1 ft^3 cement (94 lb sack) producing a slurry volume of about 1.65 ft^3/sack and weighing about 13.7 pounds per gallon. The water and required volume of bentonite will be mixed prior to the addition of cement. The cement slurry will be installed by the pressure tremie method from the top of the filter pack seal to land surface. The tremie pipe will be lowered to about 3 ft above the filter pack seal for the installation of the cement slurry.

6. SUPPORT: Electricity, Sanitary facilities and potable water will be provided by the Driller.

7. ABANDONMENT OF THE WELL: Any hole in which the Driller voluntarily stops work, and/or fails to complete in a satisfactory manner, and in accordance with the specifications and approved changes, shall be considered as abandoned by the Driller. If the Consultant then declares the hole abandoned by the Driller, no payment will be made for the abandoned hole. All abandoned holes shall be properly plugged and sealed by the Driller at his own expense in accordance with state and local regulations. All salvageable material furnished by the Driller may be removed and remain his property. The Driller shall submit a plan of action for abandonment and plugging. Casings may be removed only with the permission and approval of the Consultant. After the hole has been properly abandoned, the Driller shall drill a new hole at a location approved by the Consultant.

8. PLUMBNESS AND ALIGNMENT: The casings shall be installed in the well as near to plumb and true as possible in order that a proper cement seal can be placed in the annulus. Deviation from plumb shall not exceed 1 degree. If, in the opinion of the Consultant, it is necessary to straighten the hole, the Driller shall perform the necessary straightening procedure at his own expense.

9. SAFETY: The Driller shall be responsible for the safety of the rig and crew on the site at all times. The Driller is responsible for assuring that his personnel are adequately protected against contact hazards and/or hazardous vapors. The Driller will be responsible for all safety regulations promulgated by the State of South Carolina, and the United States Government. The Driller's representative at the site shall be familiar with these regulations and shall take all necessary measures to assure that Driller's personnel comply with appropriate safety regulations. In addition to any state regulations and OSHA standards the driller and any site personnel will be required to review and abide by the Health and Safety Plan (HASP) at a minimum. In the event that unsafe conditions arise, the site safety officer has the authority to stop work of all subcontractor drilling or related activities.

   The minimum level of protection required at each drilling location would be a modified Level D, but will be evaluated based on site conditions, site safety officer, and/or the HASP. In the event that the personnel protection level is upgraded from Level D to Level C, all subcontractors will provide full-face respirators equipped with an appropriate canister for their own employees from those approved by the National Institute for Occupational Safety and Health under provisions of 30 CFR Part II. All canisters used at Level C personnel protection sites will be disposed of after 4 hours of use and fresh canisters installed prior to work start.

10. HOUSEKEEPING: The Driller shall maintain good housekeeping at all times. Facilities and equipment should be kept neat, clean, and orderly. All trash should be contained at each well site and disposed of periodically. At the conclusion of work at each site, the drill cuttings will be cleaned up and the site returned to original grade. Any trash, scrap debris, concrete, etc., shall be removed and disposed of at the appropriate disposal facilities.

12. SITE CLEANUP: At the conclusion of work at each site, any trash, scrap, debris, concrete, etc., shall be removed and disposed of at the appropriate disposal site by the Driller before proceeding to other sites.

13. DEVIATIONS: All work shall be performed based on these specifications and the scope of work. All items, tasks, and requirements of these specifications and scope of work must be accomplished and/or executed and are subject to the approval of the Consultant. Deviations to these specifications must be approved in writing by the Driller and the Consultant.

14. DETAILED DESCRIPTION OF WORK:

    A. Well Construction Design for Five Bedrock Monitoring Wells

       (1) Equipment: All drilling equipment and well material will be thoroughly steam cleaned at the facility before installation of each monitoring well. No lubricants will be allowed on drill

rods. Any compressor used during drilling or development must be equipped with oil removal filters to prevent oil from being introduced into the wells.

(2) Surface Borehole: The surface borehole will be drilled to the top of bedrock with a nominal 10-inch bit. The borehole will be extended into competent bedrock with an air hammer.

(3) Formation Samples: The Driller shall collect formation samples during all drilling. Samples will be collected change of formation, or as directed by the Consultant. The sampling procedures will not interfere with the Driller's operations or cause him any delay. Samples are to be stored in clear plastic bags supplied by the Driller and labeled as to well designation and sample interval.

(4) Surface Casing for Monitoring Wells: A six inch PVC surface casing with screen shall be installed using Schedule 40 PVC casing at least five feet into competent bedrock unless the water table is within the uppermost five feet, in which case the well will be completed as a type 1 cased well.

(5) Cementing for Surface Casing: A cement grout will be installed by the pressure tremie method, from total depth of the surface casing to land surface. Cement shall be Class A, containing 3 percent bentonite as specified above.

(6) Bedrock Drilling: After the cement has set for a minimum of 24 hours (this time will not be billed as standby time), the driller will drill the inner open borehole with a 4 or 6 inch diameter air hammer to a depth specified by the consultant. The well should be capable of producing at least one gallon per minute.

(7) Development. The well shall be developed by swabbing the open borehole and alternately pumping the well for a period of about 4 hours and/or until clear, sediment-free water is produced. Air-lifting or bailing may be used in conjunction with swabbing but will not be the primary method of development. Any compressor used during development must be equipped with oil removal filters to prevent oil from being introduced into the wells. The Driller will be compensated only for time accrued during actual well development. Well development tools must be approved by the Consultant prior to use.

(8) Protective Casing for Monitoring Well: Monitoring wells not in high traffic areas will be completed with a three foot square concrete pad, and a steel protective casing painted the color chosen by the consultant. The protective casing will be grouted over the well casing to within 2 inches of the top of the inner casing and a weep hole will be installed in the protective casing to drain water. A stainless steel tag will be permanently fixed to the outer casing identifying the well, Company name and driller certification, total depth, screened interval, and date installed meeting South Carolina well standards. Monitoring wells in high traffic areas will be completed at ground surface with a steel meter box cover cemented into place with concrete.

(9) The driller will complete a Water Well Record Form 1903 for each monitoring well installed.

ARCADIS

ARCADIS
6723 Towpath Road
P.O. Box 66
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.0017

MEMO

To:
Joe Ferguson
Schlumberger Technology Corporation

Copies:
Katherine Stinson, STC
Gary Odom, STC
Paul Doody, ARCADIS
Chris Moody. ARCADIS
B. Scott Cary, ARCADIS

From:
Lance Ketcham

Date:
January 22, 2010

ARCADIS Project No.:
MT001019.0001.00014

Subject:
Water Quality Monitoring for Water Treatment Facility
Twelvemile Creek Restoration
Pickens County, South Carolina

The purpose of this document is to develop and present a proposed strategy and approach for the collection of water treatment discharge samples and measurement of water quality parameters associated with Schlumberger Technology Corporation's (Schlumberger's) Twelvemile Creek Restoration Project (Project). This memorandum describes requirements, procedures, and reporting for water treatment discharge monitoring during water treatment operations.

The specific permit requirements are referenced in the letter from South Carolina Department of Health and Environmental Control (SCDHEC) in Attachment A and presented in Table A.

1. Water Treatment Effluent Monitoring in Twelvemile Creek

In order to meet Federal Clean Water Act and State of South Carolina requirements, Schlumberger proposed to perform water quality monitoring on the water treatment plant effluent. The frequency of water treatment plant effluent sampling and specific sampling location were not specified in the FDR or submittals to SCDHEC. The proposed method for performing effluent monitoring from the water treatment plant is an automated approach utilizing a 24-hour composite sampler as well as manually collected grab samples in accordance with the October 15th, 2009 letter from SCDHEC (Attachment A).

1.1 Water Treatment Effluent Sample Collection

Water treatment discharge monitoring will be administered in accordance with the October 15th, 2009 letter from SCDHEC (Attachment A) and to verify the water treatment system is functioning as intended. Water treatment discharge monitoring will be conducted via a 24-hour composite automatic sampler or manually collected grab samples as required by SCDHEC. Sample collection, documentation, labeling, and handling procedures are presented in the Standard Operating Procedure (SOP) provided in Attachments C and D.

Automatic 24-hour composite sampling will be performed via an Instrumentation Specialties Company (ISCO) Avalanche Refrigerated (AR), or approved equal, sampler (sampler). The AR sampler is recommended because it has a self-contained power source and is easily portable. Attachment B provides an overview of standard features and specifications of the sampler. The sampler will be installed at the approximate location shown on Figure 1. The sampler will be installed in a manner that will minimize the length of tubing between the sampling port and the sampler. The sampler intake tubing will be sloped to avoid pooling of stagnant water in the tubing between collections of sample aliquots. The sampler will be programmed to withdraw a sample aliquot at a time interval that is 1/24 of the compositing period.

The sampler (Attachment B) may be modified to accommodate laboratory sample containers, so that the samples will be discharged directly into the containers that will be shipped to the laboratories; transferring samples from a collection vessel to a laboratory container will not be required. The sampler will be serviced by field personnel each day that samples are collected. Following collection, samples will be packaged and shipped to the laboratory for analysis of polychlorinated biphenyls (PCBs) via method 8082, and total suspended solids (TSS) via method 160.2. Testing for pH grab sampling will be performed on site. Please see the following table (Table 1) for water treatment effluent monitoring requirements discharge limits:

Table 1 - Effluent Discharge Requirements

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow	MR[1], MGD	MR[1], MGD	1/Week	Estimate
Total Suspended Solids (TSS)	25 mg/l	45 mg/l	1/Week	24 Hr Comp
Polychlorinated Biphenyls (PCBs)[2]	0.00138 µg/l	0.00202 µg/l	1/Week	24 Hr Comp
pH	Min 6.0 s.u., Max 8.5 s.u.		1/Week	Grab

Notes:
1. Monitor and Report (MR)
2. See Special Condition 12 from Attachment A (PQL for PCB's is .50 µg/l [EPA Method 608])
3. Million Gallons per Day (MGD)
4. Milligrams per Liter (mg/l)

1.2 Water Treatment Plant Effluent Toxicity Sample Collection

In addition to the water treatment effluent sample collection discussed above, toxicity testing is required by SCDHEC. Sample collection activities will be conducted at the approximate location provided in Figure 1 at a monthly frequency as specified by SCDHEC. The location was selected based on the approximate water treatment discharge location and may be adjusted based on water treatment plant effluent piping installation. Collection of water treatment plant effluent samples will be performed manually as grab samples or automatically as 24-hour composite samples. Following collection, samples will be packaged and shipped to an analytical laboratory for analysis of toxicity via Whole Effluent Toxicity (WET) methods. Sample collection, documentation, labeling, and handling procedures are presented in the SOP provided in Attachments C and D. Please see the following tables (Tables 2 and 3) for water treatment effluent discharge limits:

Table 2 - Chronic Toxicity Testing

Effluent Characteristics	Discharge Limitations		Monitoring Requirements	
	Monthly Average	Maximum	Measurement Frequency	Sample Type
Ceriodaphnia dubia Chronic Whole Effluent Toxicity @ CTC= 17.4%	25 %[2]	40 %[2]	1/month[3]	24 hour composite
Ceriodaphnia dubia Chronic Whole Effluent Toxicity-Reproduction @ CTC=17.4%	MR %[2]	MR %[2]	1/month[3]	24 hour composite
Ceriodaphnia dubia Chronic Whole Effluent Toxicity- 7-day Survival @ CTC=17.4%	MR %[2]	MR %[2]	1/month[3]	24 hour composite

Notes:
1. Maximum is defined as the highest percent effect of all valid tests performed during the monitoring period following the procedures in Special Condition No. 5 from Attachment A.
2. See Special Condition No. 5 from Attachment A for additional toxicity reporting requirements.
3. Valid tests must be separated by at least 7 days (from the time the first sample is taken to start one test until the time the first sample is taken to start a different test). There is no restriction on when a new test may begin following a failed or invalid test.

Table 3 - Acute Toxicity Testing

Effluent Characteristics	Discharge Limitations		Monitoring Requirements	
	Monthly Average	Maximum	Measurement Frequency	Sample Type
Ceriodaphnia dubia Acute Whole Effluent Toxicity @ ATC= 35.5%	-	0	1/month	Grab Sample

1.3 Water Treatment Plant Effluent Flow Monitoring

The "maximum daily" and "average monthly" water treatment plant effluent flows will be measured by the water treatment plant ultrasonic flow meters located at the water treatment plant on the plant effluent pipeline. Daily and monthly flow monitoring measurements will be recorded and documented in daily and monthly report summaries.

1.4 Reporting and Corrective Action

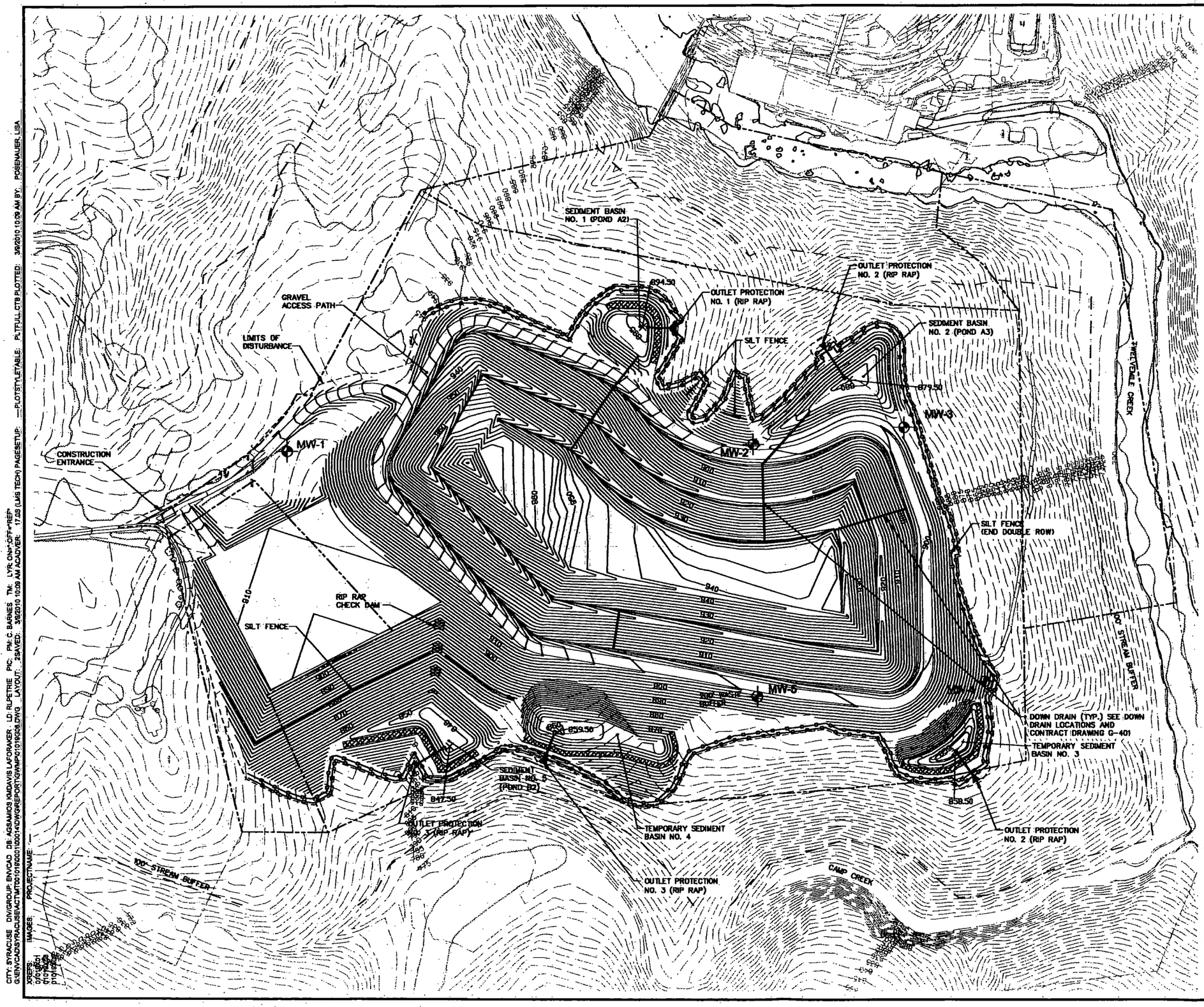
Water treatment operations and monitoring data will be compiled and retained at the project trailer for review on a weekly basis and reported both qualitatively and quantitatively in monthly progress reports. In the event of an exceedance of the water quality standards, as previously specified in Section 1.2, corrective action will be implemented immediately to regulate constituent/quality standards to below required action levels. Laboratory testing results will be required to be performed to meet a 48-hour turnaround time. Water treatment plant effluent discharge sampling results will be transmitted to SCDHEC in a monthly summary report.

The primary corrective action measure in response to an exceedance will consist of immediate observation of water treatment operations including, but not limited to, investigation of pressure gauges, tank water levels, flow meters, and other associated components of the system. Necessary adjustments to the treatment system will occur, to return the system to functioning as designed and achieving water quality standards. Secondary corrective action measures will include the replacement of non-functioning treatment system units identified as source of the exceedance. Such system components will be taken off-line, repaired and/or replaced (including backwashing and media replacement activities) to return the system to fully operational and meeting regulatory standards. The actions taken to mitigate any exceedance will be documented in the weekly and monthly progress reports, as required.

Upon your approval, we are prepared to work with your purchasing group to acquire the proposed equipment and associated support items.

Attachments

Figure 1	Monitoring Location Plan
Table A	Effluent Discharge Requirements
Attachment A	October 15th, 2009 SCDHEC Letter
Attachment B	ISCO Samplers Specification Sheets
Attachment C	24-Hour Runtime Composite Sampling SOP
Attachment D	Collection of Grab Samples from Facility Discharge SOP



LEGEND:

- PROPERTY LINE
- LIMITS OF DISTURBANCE
- SILT FENCE
- CONSTRUCTION ENTRANCE
- STONE OUTLET PROTECTION
- MW-3 MONITORING WELL LOCATION

NOTES:

1. LOCATE MONITORING WELLS MW1–5 ON EVEN GRADE SECTIONS OF ROAD SHOULDER (PRIOR TO SLOPE).
2. PAINT MONITORING WELL STANDPIPES YELLOW AND INSTALL LOCKING COVER.
3. INSTALL BOLLARD BETWEEN ROAD EDGE AND MONITORING WELLS MW1–5 AFTER WELLS HAVE BEEN INSTALLED (SEE G-407, DETAIL 8)
4. CONTRACTOR SHALL FIELD LOCATE MONITORING WELLS AT THE APPROXIMATE LOCATIONS SHOWN, TO AVOID CONFLICTS WITH EXISTING SITE FEATURES AND UTILITIES.
5. AREAS DOWNGRADIENT OF THE SMU SHALL BE REVIEWED FOR SEEPS AND SAMPLED IN ACCORDANCE WITH THE GROUNDWATER MONITORING PLAN.

0 100' 200'
GRAPHIC SCALE

SCHLUMBERGER TECHNOLOGY CORPORATION
PICKENS COUNTY, SOUTH CAROLINA
TWELVEMILE CREEK RESTORATION GROUNDWATER MONITORING PLAN

PROPOSED MONITORING WELL SAMPLING LOCATIONS

ARCADIS | FIGURE 2

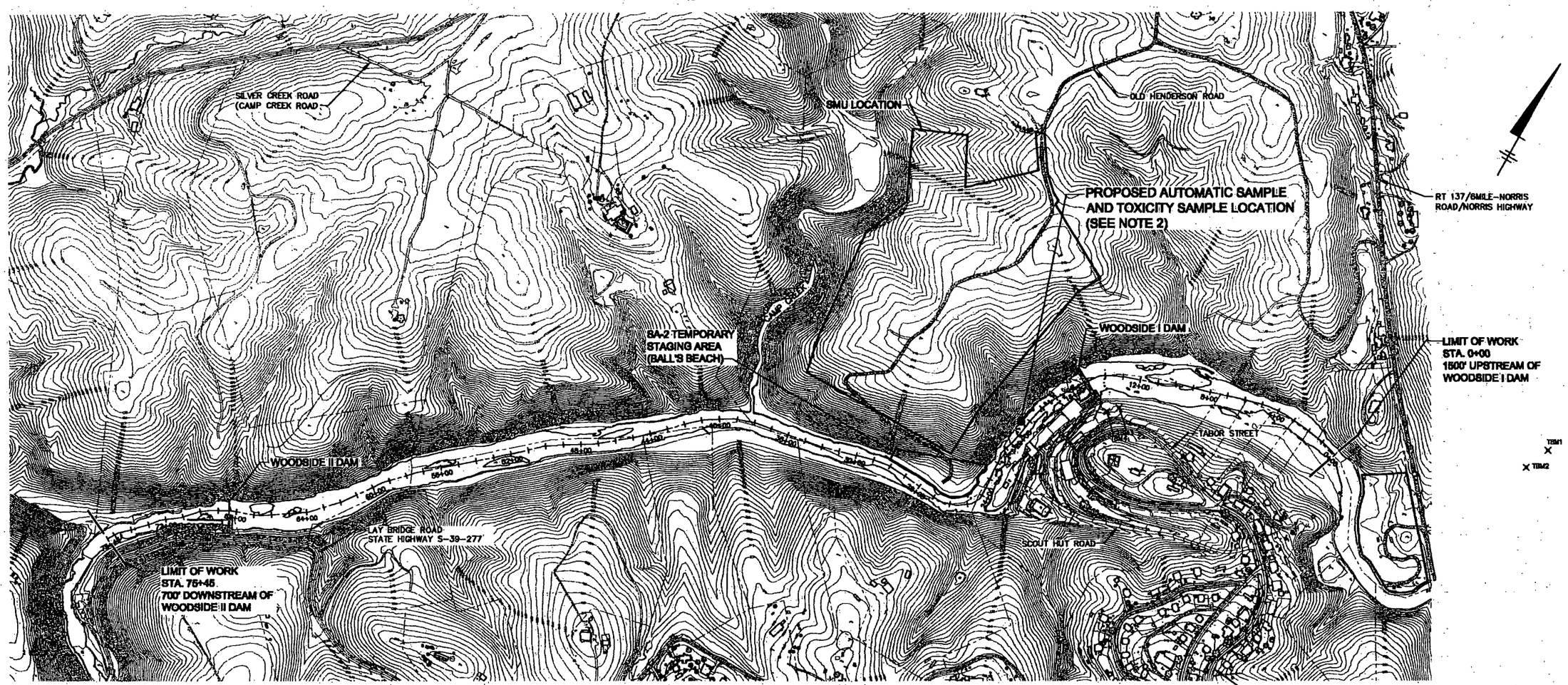
ARCADIS

Attachments

ARCADIS

Figure 1

Monitoring Location Plan



PROTECT BASF INTAKE STRUCTURE APPROX. 500 FT DOWNSTREAM OF THE LIMIT OF WORK.

LEGEND:

- EXISTING GRADE CONTOUR
- PROPERTY LINE
- PROPOSED ACCESS ROAD LOCATION

NOTES:

1. BASE MAP OBTAINED FROM SITE DESIGN, INC. AND THE PICKENS COUNTY GIS DEPARTMENT.
2. AUTOMATIC COMPOSITE SAMPLER AND TOXICITY GRAB SAMPLE LOCATION IS APPROXIMATE AND SHOULD BE COORDINATED WITH THE INSTALLATION OF THE WATER TREATMENT PLAN EFFLUENT OUTFALL LOCATION.
3. IN THE EVENT THE AUTOMATED COMPOSITE SAMPLER IS INOPERABLE, MANUAL COMPOSITE SAMPLING WOULD BE OBTAINED AT THE OUTFALL LOCATION.

0 300' 600'
GRAPHIC SCALE

SCHLUMBERGER TECHNOLOGY CORPORATION
SANGAMO WESTON/TWELVEMILE CREEK/LAKE HARTWELL PCB CONTAMINATION SUPERFUND SITE
PICKENS COUNTY, SOUTH CAROLINA
WATER TREATMENT PLANT WATER QUALITY MONITORING

MONITORING LOCATION

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FIGURE 1

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Table A

Effluent Discharge Requirements

Table A
Effluent Discharge Requirements

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

1	Estimated Flow	1 sample/week	Sample type - estimate
2	Total Suspended Solids (TSS)	1 (24-hour) composite sample/week	Limitations: Monthly Average - 25 mg/l Daily Maximum - 45 mg/l
3	Polychlorinated Biphenyls (PCBs)	1 (24-hour) composite sample/week	0.50 µg/l
4	pH	1 grab sample/week	Min 6.0 s.u., Max 8.5 s.u.
5	Chronic Whole Effluent Toxicity (WET)	1 sample/week	All valid toxicity test results shall be submitted to the Department. In addition, results from all invalid tests must be appended to the valid toxicity results, including lab control data. The permittee has sole responsibility for scheduling toxicity tests so as to ensure there is sufficient opportunity to complete and report the required number of valid test results for each monitoring period. The permittee is responsible for reporting a valid test during each monitoring period. However, the Department acknowledges that invalid tests may occur. All of the following conditions must be satisfied for the permittee to be in compliance with WET testing requirements for a particular monitoring period when a valid test was not obtained. (1) A minimum of three (3) tests have been conducted; (2) The data and results of all invalid tests are attached to the sample report; (3) At least one additional State-certified laboratory is used after two (2) consecutive invalid tests were determined by the first laboratory. The name(s) and lab certification number(s) of the additional lab(s) shall be reported with the sample results report; and (4) A valid test was reported during each of the previous three reporting periods. If these conditions are satisfied, the permittee may enter "H" on the sample results page and add the statement that "H indicates invalid tests."
6	Chronic WET - Reproduction	1 sample/week	
7	Chronic WET - 7-day Survival	1 sample/week	

Table A
Effluent Discharge Requirements

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

8	Acute WET	1 sample/week	The WET requirements for the acute toxicity test: a. The permittee must report whether the test passes or fails at the specified ATC. If more than one test is performed during a monitoring period (including tests from split samples), the worst case result shall be reported. b. All valid toxicity test results shall be submitted. In addition, results from all invalid tests must be reported including lab control data. The permittee has sole responsibility for scheduling toxicity tests so as to ensure there is sufficient opportunity to complete and report the required number of valid test results for each monitoring period. c. The permittee is responsible for reporting a valid test during each monitoring period. However, the Department acknowledges that invalid tests may occur. All of the following conditions must be satisfied for the permittee to be in compliance with Whole Effluent Toxicity (WET) testing requirements for a particular monitoring period when a valid test was not obtained. (1) A minimum of five (5) tests have been conducted; (2) The data and results of all invalid tests are reported; (3) At least one additional State-certified laboratory is used after two (2) consecutive invalid tests were determined by the first laboratory. The name(s) and lab certification number(s) of the additional lab(s) shall be reported; and
9	Proper Operation and Maintenance (O&M)	At all times	At all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment and control (and related appurtenances). Proper operation and maintenance includes effective performance based on design facility removals, adequate funding, adequate operator staffing and training and also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the

Table A
Effluent Discharge Requirements

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

10	O&M Plan	Prior to wastewater treatment, only if O&M manual and operator required	Develop and maintain at the facility a complete Operations and Maintenance Manual for the waste treatment facilities. The manual shall be made available for on-site review during normal working hours. The manual shall contain operation and maintenance instructions for all equipment and appurtenances associated with the waste treatment facilities and land application system, if applicable. The manual shall contain a general description of the treatment process(es), the operational procedures to meet the requirements of E.1 above, and the corrective action to be taken should operating difficulties be encountered.
11	Daily Inspections	Daily - change as necessary according to R.61.9.122.41(e)(3)	Provide for the performance of daily treatment facility inspections by a certified operator. The Department may make exceptions to the daily operator requirement in accordance with R.61-9.122.41(e)(3)(ii). The inspections shall include, but should not necessarily be limited to, areas which require visual observation to determine efficient operation and for which immediate corrective measures can be taken using the O & M manual as a guide. All inspections shall be recorded and shall include the date, time, and name of the person making the inspection, corrective measures taken, and routine equipment maintenance, repair, or replacement performed. The permittee shall maintain all records of inspections at the permitted facility as required by the permit, and the records shall be made available for on-site review during normal working hours.
12	Restrict Discharge	At all times	There shall be no discharge of floating solids or visible foam in other than trace amounts, nor shall the effluent cause a visible sheen on the receiving waters.
13	Access Road Maintenance	At all times	Maintain an all weather access road to the wastewater treatment plant, land application areas, and appurtenances at all times.
14	Waste Disposal	At all times	All waste oil and solid and hazardous waste shall be disposed of in accordance with the rules and regulations of SCDHEC's Bureau of Land and Waste Management.

Table A
Effluent Discharge Requirements

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

15	Monitoring	1st Monday of every calendar month and additionally in order to meet frequency requirements	Monitor all parameters consistent with conditions established by DHEC on the 1st Monday of every calendar month in which sampling is required, unless otherwise approved by this Department. If this day falls on a holiday, sampling shall be conducted on the next business day. If no discharge occurs on this day, the permittee shall collect an effluent sample during the reporting period on a day when there is a discharge or report "no discharge" for the reporting period for all parameters. Additional monitoring as necessary to meet the frequency requirements shall be performed.
16	Flow Measurement	As necessary	Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be present and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to ensure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than 10% from the true discharge rates throughout the range of expected discharge volumes. The primary flow device, where required, must be accessible to the use of a continuous flow recorder.
17	Best Management Practices Plan	Prior to wastewater treatment	The permittee shall update and maintain a Best Management Practices (BMP) plan to identify and control the discharge of significant amounts of oils and the hazardous and toxic substances listed in 40 CFR Part 117 and Tables II and III of Appendix D to 40 CFR Part 122. The plan shall include a listing of all potential sources of spills or leaks of these materials, a method for containment, a description of training, inspection and security procedures, and emergency response measures to be taken in the event of a discharge to surface waters or plans and/or procedures which constitute an equivalent BMP. Sources of such discharges may include materials storage areas; in plant transfer, process and material handling areas; loading and unloading operations; plant site runoff; and sludge and waste disposal areas. The BMP plan shall be developed in accordance with good engineering practices, shall be documented in narrative form, and shall include any necessary plot plans, drawings, or maps. The BMP plan shall be maintained at the plant site and shall be available for

Table A
Effluent Discharge Requirements

Twelvemile Creek Restoration
Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site

Schlumberger Technology Corporation

18	Report Submittal	Monthly no later than the 28th day of the month following the end of the monitoring period	The results of wastewater discharge sampling and any other reports as detailed in this letter should be sent on a monthly basis attn: Butch Swygert at the following address: SC Department of Health & Environmental Control Bureau of Water 2600 Bull Street Columbia, SC, 29201 Note: Effluent monitoring results obtained at the required frequency are due postmarked no later than the 28th day of the month following the end of the monitoring period.

Note:
1. Requirements are presented in DHEC's October 15, 2009 Wastewater Discharge Limits letter.

ARCADIS

Attachment A

October 15, 2009 SCDHEC Letter

October 15, 2009

Mr. Chris Moody, P.G.
ARCADIS
111 Southwest Columbia Street
Suite 725
Portland, OR 97201

RE: Wastewater Discharge Limits
Twelvemile Creek Restoration Project
Pickens County, South Carolina

Dear Mr. Moody:

The following wastewater discharge limitations have been calculated for the Twelvmile Creek Project restoration (TMC). I took the parameters from the 2D application and applied them to the spreadsheets, which I have attached. These spreadsheets determine which parameters showed reasonable potential to violate water quality standards. I developed a rationale, which contains information about the project and how the limitations were derived.

Table 1 below contains the limits along with the monitoring requirements for the TMC discharge to Twelvemile Creek. Following Table 1 will be the whole effluent Toxicity (WET) limitations and the special conditions which apply to the discharge and site.

TABLE 1

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Average	Daily Maximum	Sampling Frequency	Sample Type
Flow	MR[1], MGD	MR[1], MGD	1/Week	Estimate
Total Suspended Solids (TSS)	25 mg/l	45 mg/l	1/Week	24 Hr Comp
Polychlorinated Biphenyls (PCBs)[2]	0.00138 µg/l	0.00202 µg/l	1/Week	24 Hr Comp
PH	Min 6.0 s.u., Max 8.5 s.u.		1/Week	Grab

[1]Monitor and Report
[2]See Special Condition 12

Effluent Toxicity Limitations and Monitoring Requirements

Such discharge shall be limited and monitored by the permittee as specified below:

Chronic Toxicity Testing

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Average	Maximum[1]	Measurement Frequency	Sample Type
Ceriodaphnia dubia Chronic Whole Effluent Toxicity @ CTC= 17.4%	25 %[2]	40 %[2]	1/month[3]	24 hour composite
Ceriodaphnia dubia Chronic Whole Effluent Toxicity-Reproduction @ CTC=17.4%	MR %[2]	MR %[2]	1/month[3]	24 hour composite
Ceriodaphnia dubia Chronic Whole Effluent Toxicity- 7-day Survival @ CTC=17.4%	MR %[2]	MR %[2]	1/month[3]	24 hour composite

[1]Maximum is defined as the highest percent effect of all valid tests performed during the monitoring period following the procedures in Special Condition No. 5.
[2] See Special Condition No. 5 for additional toxicity reporting requirements. MR = Monitor and Report.
[3] Valid tests must be separated by at least 7 days (from the time the first sample is taken to start one test until the time the first sample is taken to start a different test). There is no restriction on when a new test may begin following a failed or invalid test.

a. Samples used to demonstrate compliance with the discharge limitations and monitoring requirements specified above shall be taken at or near the final point-of-discharge but prior to mixing with the receiving waters or other waste streams.
b. Valid test results from split samples shall be reported to the Department. For reporting an average, individual valid results for each test from a split sample are averaged first to determine a sample value. That value is averaged with other sample results obtained in the reporting period and the average of all sample results reported. For reporting the maximum, individual valid results for each test from a split sample are averaged first to determine a sample value. That value is compared to other sample results obtained in the reporting period and the maximum of all sample results reported. For the purposes of

reporting, split samples are reported as a single sample regardless of the number of times it is split. All laboratories used shall be identified on the DMR attachment.

Acute Toxicity Testing

Such discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Ceriodaphnia dubia Acute Whole Effluent Toxicity @ ATC= 35.5%	-	0*	1/month	Grab Sample

* Report "0" if test passes or "1" if test fails in accordance with Part V.B.

a. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: at or near the discharge, but prior to mixing with the receiving waters.

Special Conditions

1. The permittee shall at all times properly operate and maintain in good working order and operate as efficiently as possible all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes effective performance based on design facility removals, adequate funding, adequate operator staffing and training and also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. The permittee shall develop and maintain at the facility a complete Operations and Maintenance Manual for the waste treatment facilities. The manual shall be made available for on-site review during normal working hours. The manual shall contain operation and maintenance instructions for all equipment and appurtenances associated with the waste treatment facilities and land application system, if applicable. The manual shall contain a general description of the treatment process(es), the operational procedures to meet the requirements of E.1 above, and the corrective action to be taken should operating difficulties be encountered.

3. The permittee shall provide for the performance of daily treatment facility inspections by a certified operator of the appropriate grade as defined in the permit To Construct to be issued by the Department. The Department may make exceptions to the daily operator requirement in accordance with R.61-9.122.41(e)(3)(ii). The inspections shall include, but should not necessarily be limited to, areas which require visual observation to determine efficient operation and for which immediate corrective measures can be taken using the O & M manual as a guide. All inspections shall be recorded and shall include the date, time, and name of the person making the inspection, corrective measures taken, and routine equipment maintenance, repair, or replacement performed. The permittee shall maintain all records of inspections at the permitted facility as required by the permit, and the records shall be made available for on-site review during normal working hours.

4. There shall be no discharge of floating solids or visible foam in other than trace amounts, nor shall the effluent cause a visible sheen on the receiving waters.

5. The WET requirements for the chronic toxicity test:

    a. A *Ceriodaphnia dubia* three brood chronic toxicity test shall be conducted at the frequency stated in Part III.B, Effluent Toxicity Limitations and Monitoring Requirements, using the following test concentrations: 0% (control), 8%, 17.4% (CTC), 35%, 50% and 100% effluent. The permittee may add additional test concentrations without prior authorization from the Department provided that the test begins with at least 10 replicates in each concentration and all data is used to determine permit compliance.

    b. The test shall be conducted using EPA Method 1002.0 in accordance with "Short-Term Methods for Estimating Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms," EPA/821/R-02/013 (October 2002).

    c. The permittee shall use the linear interpolation method described in "Short-Term Methods for Estimating Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms," EPA/821/R-02/013 (October 2002), Appendix M to estimate

the percent effect on survival and reproduction at the CTC according to the equations in d below.

d. The linear interpolation estimate of percent effect is $\left(1-\frac{M_{CTC}}{M_1}\right)*100$ if the CTC is a tested concentration. Otherwise, it is

$$\left(1-\frac{M_J-\frac{M_{J+1}-M_J}{C_{J+1}-C_J}*C_J+\frac{M_{J+1}-M_J}{C_{J+1}-C_J}*CTC}{M_1}\right)*100.$$

The permittee shall report the percent effect on both *Ceriodaphnia dubia* survival and reproduction at the CTC. Overall percent effect is the greater of the percent effect on survival and reproduction. The permittee shall also report the IC_{25} and, using the same test data, the 48-hour chronic LC_{50}.

e. A test shall be invalidated if any part of Method 1002.0 is not followed or if the laboratory is not certified at the time the test is conducted.

f. All valid toxicity test results shall be submitted to the Department. In addition, results from all invalid tests must be appended to the valid toxicity results, including lab control data. The permittee has sole responsibility for scheduling toxicity tests so as to ensure there is sufficient opportunity to complete and report the required number of valid test results for each monitoring period.

g. The permittee is responsible for reporting a valid test during each monitoring period. However, the Department acknowledges that invalid tests may occur. All of the following conditions must be satisfied for the permittee to be in compliance with Whole Effluent Toxicity (WET) testing requirements for a particular monitoring period when a valid test was not obtained.

(1) A minimum of three (3) tests have been conducted which were invalid in accordance with Special Condition 5.e above;

(2) The data and results of all invalid tests are attached to the sample report;

(3) At least one additional State-certified laboratory is used after two (2) consecutive invalid tests were determined by the first laboratory. The name(s) and lab

certification number(s) of the additional lab(s) shall be reported with the sample results report; and

(4) A valid test was reported during each of the previous three reporting periods.

If these conditions are satisfied, the permittee may enter "H" on the sample results page and add the statement that "H indicates invalid tests."

6. The WET requirements for the acute toxicity test:

a. A 48-hour static acute toxicity test shall be conducted at the frequency stated in Part III.B Effluent Toxicity Limitations and Monitoring Requirements using a control and the acute test concentration (ATC) of 35.5%. The test shall be conducted using *Ceriodaphnia dubia* as the test organism using EPA Method 2002.0 in accordance with "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms," EPA 821/R-02/012 (October 2002). The test shall be conducted at 25°C ±1°C.

b. If the test group *Ceriodaphnia dubia* survival is less than the control group survival at the 0.05α level of a left-tailed Fisher's exact test, the test shall be deemed a failure.

c. The permittee must report whether the test passes or fails at the specified ATC. If more than one test is performed during a monitoring period (including tests from split samples), the worst case result shall be reported.

d. A test shall be invalidated if any part of Method 2002.0 is not followed or if the laboratory is not certified at the time the test is conducted.

e. All valid toxicity test results shall be submitted. In addition, results from all invalid tests must be reported including lab control data. The permittee has sole responsibility for scheduling toxicity tests so as to ensure there is sufficient opportunity to complete and report the required number of valid test results for each monitoring period.

f. The permittee is responsible for reporting a valid test during each monitoring period. However, the Department acknowledges that invalid tests may occur. All of the following conditions must be satisfied for the permittee to be in compliance with Whole Effluent Toxicity (WET) testing requirements for a particular monitoring period when a valid test was not obtained.

(1) A minimum of five (5) tests have been conducted which were invalid in accordance with Part 6.a. above;

(2) The data and results of all invalid tests are reported;

(3) At least one additional State-certified laboratory is used after two (2) consecutive invalid tests were determined by the first laboratory. The name(s) and lab certification number(s) of the additional lab(s) shall be reported; and

(4) A valid test was reported during each of the previous three reporting periods.

If these conditions are satisfied, the permittee may enter "H" in the report and add the statement that "H indicates invalid tests."

7. The permittee shall maintain an all weather access road to the wastewater treatment plant, land application areas, and appurtenances at all times.

8. All waste oil and solid and hazardous waste shall be disposed of in accordance with the rules and regulations of SCDHEC's Bureau of Land and Waste Management.

9. The permittee shall monitor all parameters consistent with conditions established by this permit on the 1st Monday of every calendar month in which sampling is required, unless otherwise approved by this Department. If this day falls on a holiday, sampling shall be conducted on the next business day. If no discharge occurs on this day, the permittee shall collect an effluent sample during the reporting period on a day when there is a discharge or report "no discharge" for the reporting period for all parameters. Additional monitoring as necessary to meet the frequency requirements of this permit shall be performed by the permittee.

10. Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be present and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to ensure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than 10% from the true discharge rates throughout the range of expected discharge volumes. The primary flow device, where required, must be accessible to the use of a continuous flow recorder.

11. The permittee shall update and maintain a Best Management Practices (BMP) plan to identify and control the discharge of significant amounts of oils and the hazardous and toxic substances listed in 40 CFR Part 117 and Tables II and III of Appendix D to 40 CFR Part

122. The plan shall include a listing of all potential sources of spills or leaks of these materials, a method for containment, a description of training, inspection and security procedures, and emergency response measures to be taken in the event of a discharge to surface waters or plans and/or procedures which constitute an equivalent BMP. Sources of such discharges may include materials storage areas; in-plant transfer, process and material handling areas; loading and unloading operations; plant site runoff; and sludge and waste disposal areas. The BMP plan shall be developed in accordance with good engineering practices, shall be documented in narrative form, and shall include any necessary plot plans, drawings, or maps. The BMP plan shall be maintained at the plant site and shall be available for inspection by EPA and Department personnel.

12. Where the permit limitation Part III is below the practical quantitation limit (PQL), the PQL and analytical method stated below shall be considered as being in compliance with the permit limit. Additionally, where the permit requires only monitoring and reporting (MR) in Part III, the PQL and analytical method stated below shall be used for reporting results.

Parameter	Analytical Method	PQL
Polychlorinated Biphenyls (PCBs)	EPA Method 608	0.50 µg/l

13. The results of sampling and any other reports as detailed in this letter should be sent on a monthly basis to my attention at the following address:

SC Department of Health & Environmental Control
Bureau of Water
2600 Bull Street
Columbia, SC, 29201

Note: Effluent monitoring results obtained at the required frequency are due postmarked no later than the 28th day of the month following the end of the monitoring period.

If you have any questions concerning any of the requirements in this letter, please call me at (803) 898-4235 or e-mail me at swygercw@dhec.sc.gov.

Sincerely,

Butch Swygert
Environmental Engineer Associate
Industrial Wastewater Permitting Section

cc (via e-mail): Eric Kim, SCDHEC, Region 2/Greenville EQC District Office
Chuck Williams, SCDHEC, BL&WM
John McCain, SCDHEC, BL&WM
Grace Roster, ARCADIS
Lance Kethcham, ARCADIS
Jeff Barry, ARCADIS
Danielle Amber, ARCADIS

ARCADIS

Attachment B

ISCO Samplers Specification Sheets

Isco Product Data

Isco Avalanche® Multi-bottle, Refrigerated Portable Sampler

Multi-function sampling and data logging with dual-power cooling

Avalanche® is based on Isco's industry-leading 6712 controller. You get all the advanced control, data logging, and communication features of the 6712, with cooling from either AC or battery power.

Bottle options include 5- and 2.5 gallon composites as well as 4 x 1-gallon and 14 x 950 ml sequentials.

A 12V deep-cycle battery delivers 48 hours - or more- of refrigeration. The power-saving cooling system remains on standby until the first sample is drawn, and only then switches on to preserve the collected samples for pickup.

Available routines include: pause-and-resume for intermittent-discharge flow monitoring; sampler pacing by time, non-uniform time, flow or external event; and random interval sample collection.

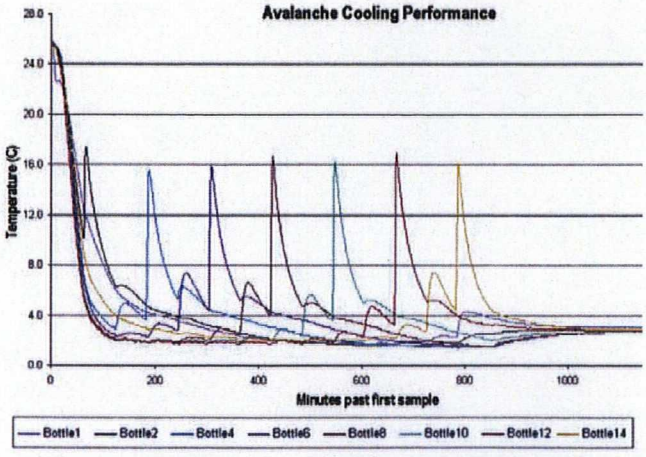
Standard Features

- Standard and extended programming keeps setup simple when you don't need advanced features.
- NEMA 4x, 6 (IP67) controller enclosure.
- SDI-12 interface provides "plug and play" connection with multi-parameter water-quality sondes and other compatible devices.
- 512kB memory gives you great flexibility for logging environmental data.
- Sample delivery at the EPA-recommended velocity of 2 ft/sec. at head heights up to 26 feet.
- Patented pump revolution counter ensures accurate sample volumes - and tells you when tubing should be replaced.

Optional mobility kit includes pneumatic tires for ease of transport over rough terrain, and a convenient battery platform.

Applications

- Stormwater runoff compliance
- TMDL and watershed monitoring
- Enforcement monitoring
- Advanced sampling combined with data logging and communications for flow, rainfall, and water quality parameters.



Isco temperature control technology accurately preserves samples at 3°C – even under difficult conditions shown above (40°C ambient, 20°C sample temperature).

Specifications

Isco Avalanche Sampler	
Size (H x W x D):	30.5 x 14 x 24 inches (78 x 36 x 60 cm)
Weight:	Dry, less battery - 76 lbs (35 kg)
Bottle configurations:	5-gallon poly bottle 2.5-gallon glass bottle configuration 2.5-gallon poly bottle configuration 1-gallon poly bottle configuration (4 bottles 950 ml poly bottle configuration (14 bottles)
Power Requirements:	12V DC (Supplied by battery or AC power converter.)

Pump	
Intake suction tubing:	
Length	3 to 99 feet (1 to 30 m)
Material	Vinyl or Teflon
Inside dimension	3/8 inch (1 cm)
Pump tubing life:	Typically 1,000,000 pump counts
Maximum lift:	28 feet (8.5 m)
Typical Repeatability	±5 ml or ±5% of the average volume in a set
Typical line velocity at Head height of	
3 ft. (0.9 m)	3.0 ft./s (0.91 m/s)
10 ft. (3.1 m)	2.9 ft./s (0.87 m/s)
15 ft. (4.6 m)	2.7 ft./s (0.83 m/s)
Liquid presence detector:	Non-wetted, non-conductive sensor detects when liquid sample reaches the pump to automatically compensate for changes in head heights.

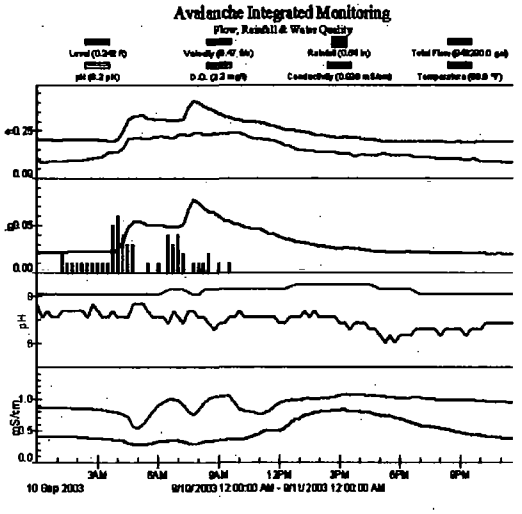
Controller	
Weight:	13 lbs. (5.9 kg)
Size (HxWxD)	10.3 x 12.5 x 10 inches (26 x 31.7 x 25.4 cm)
Operational temperature:	32° to 120°F (0° to 49°C)
Enclosure rating:	NEMA 4X, 6 (IP67)
Program memory:	Non-volatile ROM
Flow meter signal input:	5 to 15 volt DC pulse or 25 millisecond isolated contact closure.
No. of composite samples:	Programmable from 1 to 999 samples.
Clock Accuracy:	1 minute per month, typical, for real time clock

Software	
Sample frequency:	1 minute to 99 hours 59 minutes, in 1 minute increments. Non-uniform times in minutes or clock times 1 to 9,999 flow pulses
Sampling modes:	Uniform time, non-uniform time, flow, event. (Flow mode is controlled by external flow meter pulses.)
Programmable sample volumes:	10 to 9,990 ml in 1 ml increments
Sample retries:	If no sample is detected, up to 3 attempts; user selectable
Rinse cycles:	Automatic rinsing of suction line up to 3 rinses for each sample collection
Program storage:	5 sampling programs
Sampling Stop/Resume:	Up to 24 real time/date sample stop/resume commands
Controller diagnostics:	Tests for RAM, ROM, pump, display, and distributor

Ordering Information

Note: *Bottle configuration, suction line, and strainer must be ordered separately. 12 VDC operation requires external battery. Contact Isco or your Isco Representative for complete information.*

Description	Part Number
Isco Avalanche Sampler (115-230 VAC/12V DC) Includes controller, distributor arm, instruction manual, pocket guide. Standard power cord.*	**68-2970-003**
5-gallon poly bottle	**68-2970-008**
2.5-gallon glass bottle configuration	**68-2970-006**
2.5-gallon poly bottle configuration	**68-2970-009**
1-gallon poly bottle configuration (4 bottles	**68-2970-002**
950 ml poly bottle configuration (14 bottles)	**68-2970-001**
Mobility Kit	**68-2960-004**



The Avalanche controller is a powerful SDI-12 data logger, designed to work directly with Isco's advanced Flowlink® Software.

Data for flow, rainfall, and water quality can be transferred from the Avalanche controller into a Flowlink-equipped PC in three ways: via cable connection, via Isco's 2102 Wireless Communication System, or by phone, using Avalanche's optional built-in modem

Flowlink Software lets you quickly retrieve, import, compare, and analyze data, generate charts and graphs,and create comprehensive reports.

ISCO®
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Teledyne Isco, Inc.
4700 Superior Street
Lincoln NE 68504 USA
Phone: (402) 464-0231
USA and Canada: (800) 228-4373
Fax: (402) 465-3022
E-Mail: iscoinfo@teledyne.com
Internet: www.isco.com

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Attachment C

24-Hour Runtime Composite Sampling SOP

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I. Scope and Application

This Standard Operating Procedure (SOP) applies to the collection of water treatment plant discharge composite samples, using an ISCO sampler. A 24-hour runtime composite sample of the discharge from the water treatment plant will be collected weekly.

II. Personnel Qualifications

Field personnel, trained in the use of an ISCO sampler, will collect the composite samples. All field personnel are required to take a 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations training course and annual refresher courses, and participate in a medical monitoring program prior to engaging in any field collection activities as required in 29 CFR 1910.120. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

III. Equipment List

Equipment needed to collect water treatment plant discharge composite samples includes:

- ISCO sampler (ISCO Avalanche Multi-bottle Sampler or equivalent)
- At least four 1-gallon glass, pre-cleaned sample collection vessels (designed for specific ISCO sampler)
- Battery power source for ISCO sampler
- Disposable gloves
- Sample containers (two 1-liter amber glass bottles with Teflon®-lined lids from laboratory)
- Plastic (polyethylene) resealable food storage bags
- Plastic (polyethylene) trash bags
- Dedicated Teflon® suction line

- Dedicated, clean cooler with ice
- Box or container for transport of used sample collection vessel
- Field notebook
- Chain of custody forms
- Labels for sample containers
- Permanent marker

IV. Cautions

Sample containers should be packed on ice and stored in a cool, shaded place to maintain a sample temperature of approximately 4 C, if possible. Ice must be double-bagged to prevent leaks. Sample containers should be stored inside sealable plastic bags to prevent interference from external sources should a container break during transit.

V. Health and Safety Considerations

Health and safety issues are addressed in the site Health and Safety Plan.

VI. Procedures

The ISCO sampler will be operated according to the procedures contained in the operating manual. The procedure for collecting the composite samples is summarized below:

1. Complete project and sample location information.
2. Put on a new pair of disposable gloves.
3. Connect the battery to the ISCO sampler in, connect the dedicated Teflon® suction line to the pump tubing and the sample tap, open the sample tap and turn the sampler on.
4. Verify that the refrigerator is set to 4°C.

5. Make sure the ISCO sampler is programmed to collect a 24-hour runtime composite sample with a sample collection frequency of one discrete volume of sample per hour.

6. Return to the sample station 24 hours later.

7. Put on a new pair of disposable gloves.

8. Turn off the sampler.

9. Remove the sample collection vessel from the ISCO sampler.

10. Transfer the composite sample to the appropriate sample containers (i.e., two 1-liter amber glass bottles with Teflon®-lined lids).

11. Affix a label to each sample container and record the following information on the label: date and time of sample retrieval, sample identification, and analysis method. Note:

12. Seal the sample containers in resealable plastic bags; label the bags with date, time, and sample identification; and place the bags in the cooler with ice.

13. Complete the chain of custody form in accordance with the specifications.

14. Place the used sample collection vessel in a separate container for delivery to the laboratory for cleaning.

15. Put on a new pair of disposable gloves.

16. Place a clean sample collection vessel (pre-cleaned by the laboratory) in the ISCO sampler.

17. Unplug the ISCO sampler from the battery.

VII. Calibration and Maintenance

Calibration of the ISCO Avalanche Multi-bottle Sampler is necessary to provide sample volume accuracy and should occur prior to each use. Calibration will be noted in the field

notebook. The specific steps to calibrate the ISCO sampler are presented in the installation and operation guide.

Maintenance of the ISCO sampler includes both routine and preventative maintenance. General maintenance procedures are provided herein and are detailed in the installation and operation guide.

Routine maintenance procedures include:

- Clean the interior and exterior of the refrigerator, the controller, bottles, strainer, and tubing.
- Clean the condenser coil and surrounding areas annually.
- Follow the cleaning protocols for priority pollutants and critical sampling. This procedure is detailed below.
- Replace the pump tube when the display shows a warning at 500,000 pump counts or when inspection reveals any cracks or defects.
- Replace the dedicated Teflon® suction line on an annual basis.

Preventative maintenance includes:

- Replace the internal desiccant when the internal case humidity exceeds 30%. The internal case humidity is shown on the indicator visible through the front panel label (the indicator turns pink or white when the humidity level exceeds the printed value).

If experiencing problems with the sampler, contact Teledyne ISCO's Repair Service Department at (402) 464-0231.

VIII. Decontamination of Equipment

The equipment cleaning procedures described herein include pre-field, in-field, and post-field cleaning of sampling equipment, which will be conducted at an established equipment decontamination area (EDA) onsite (as appropriate). Cleaning procedures for sampling equipment will be monitored by collecting field blank samples as specified in the applicable work plan.

The following materials, as required, will be available during field cleaning procedures:

- Health and safety equipment, as required in the site Health and Safety Plan including personal protective equipment (PPE)
- Distilled/deionized water
- Nonphosphate detergent
- Tap water
- Appropriate cleaning solvent (e.g., hydrochloric acid [HCl], nitric acid [HNO3], hexane, acetone, isopropanol, methanol)
- Rinsate collection plastic containers
- Plastic overpack drum
- Brushes
- Plastic sheeting
- Aluminum foil
- Large heavy-duty garbage bags
- Spray bottles
- Resealable-type bags
- Handiwipes
- Field notebook

Ensure to rinse equipment thoroughly and allow the equipment to dry before reuse or storage to prevent introducing solvent into sample medium.

Review the material safety data sheets (MSDSs) for the solvents to be used in the decontamination. Avoid use of spray bottles to apply solvent on equipment to minimize

potential for introducing vapors into breathing zone. Work in a well-ventilated area and stand upwind while applying solvent to equipment during the decontamination process. Application of solvent to the equipment will be completed in a manner that minimizes potential for exposure to workers. Follow health and safety procedures outlined in the HASP.

A designated area will be established to clean sampling equipment in the field prior to and between sample collection. Equipment cleaning areas will be set up within or adjacent to the specific work area.

The manufacturer suggests the use of decontamination protocols used in National Pollutant Discharge Elimination System (NPDES) compliance monitoring, as described below:

- Glass Sample Bottles

    1. One spectro-grade acetone rinse.
    2. Dishwasher cycle (wash and tap water rinse, no detergent).
    3. Acid wash with at least 20% HCl.
    4. Dishwasher cycle (wash and tap water rinse, no detergent).
    5. Replace in covered Teledyne ISCO bases.

- Teflon® Suction Line

    1. Rinse twice with spectro-grade acetone.
    2. Rinse thoroughly with hot tap water using a brush, if possible, to remove particulate matter and surface film.
    3. Rinse thoroughly three times with tap water.
    4. Acid wash with at least 20% HCl.
    5. Rinse thoroughly three times with tap water.

6. Rinse thoroughly three times with distilled water.

7. Rinse thoroughly with petroleum ether and dry by pulling air through the line.

8. Dry overnight in a warm oven (use an oven temperature of lower than 150 F), if possible.

9. Cap ends with aluminum foil.

- Pump Tubes

1. Rinse by pumping hot tap water through the tube for at least 2 minutes.

2. Acid wash the tube by pumping at least a 20% solution of HCl through the tube for at least 2 minutes.

3. Rinse by pumping hot tap water through the tube for at least 2 minutes.

4. Rinse by pumping distilled water through the tube for at least 2 minutes.

IX. Waste Management

Waste generated during retrieval of the composite samples and during decontamination, such as disposable gloves and other expendables, will be placed in labeled 55-gallon drums onsite.

X. Data Recording and Management

Equipment cleaning and decontamination will be noted in the field notebook. An inventory of the solvents brought onsite and used and removed from the site will be maintained in the files. Containers with decontamination fluids will be labeled.

XI. Quality Assurance

Field QA/QC samples to be collected are equipment rinse blank samples, field duplicates, and matrix spike samples. Matrix spike samples and field duplicates will be prepared by filling additional appropriately marked containers. Equipment blank samples will be prepared as follows:

1. Put on new disposable gloves.
2. Place a clean sample collection vessel in the ISCO sampler.
3. Slowly pour distilled water into the sampler intake and fill enough of the sample collection vessel to provide sufficient sample volume to fill the sample container.
4. When nearly full, remove the sample collection vessel and distribute to appropriately labeled sample container.
5. After collection, handle equipment blank sample in a manner that is consistent with all other environmental samples.
6. After preparing the equipment blank sample, the sample collection vessel may be reused to collect processing facility discharge samples without cleaning.

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Attachment D

Collection of Grab Samples from Facility Discharge SOP

I. Scope and Application

This Standard Operating Procedure (SOP) applies to the collection of water treatment plant effluent discharge grab samples, via a tap in the discharge line, for various required analyses, and pH measurements during water treatment plant operation. The parameters that will be monitored weekly are listed below:

- pH
- Acute Toxicity Testing

II. Personnel Qualifications

Field personnel, trained in grab sampling procedures, will collect the grab samples. All field personnel are required to take a 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations (HAZWOPER) training course and annual refresher courses, and participate in a medical monitoring program prior to engaging in any field collection activities as required in 29 CFR 1910.120. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

III. Equipment List

Equipment needed to collect processing facility discharge grab samples includes:

- Health and safety equipment
- pH meters
- Glass sample containers
- Standard solutions for calibration
- Extra batteries for the pH meter
- Disposable non-talc gloves
- Pre-preserved sample containers

- Plastic (polyethylene) resealable food storage bags
- Polyethylene wrap
- Distilled water
- Dedicated, clean cooler with ice
- Field notebook and forms
- Chain of custody forms
- Labels for sample containers
- Permanent marker

IV. Cautions

Potential sources of trace metals contamination during sampling include metallic or metal-containing sampling equipment, containers, personal protective equipment (PPE), reagent water, and improperly cleaned and stored equipment.

Sample containers should be packed on ice and stored in a cool, shaded place to maintain a sample temperature of approximately 4 C, if possible. Ice must be double-bagged to prevent leaks. Sample containers should be stored inside sealable plastic bags to prevent interference from external sources should a container break during transit.

V. Procedures for Collecting Acute Toxicity Grab Samples

The procedure for collecting the acute toxicity grab samples is described below:

1. Complete project and sample location information.
2. Put on a new pair of disposable gloves.
3. Fill appropriate sample container from the grab sample tap in discharge line.

4. Affix a label to each sample container and record the following information (on the label: date and time of sample retrieval, sample identification, and analysis method/parameter. Note: the sample identification is "Water Treatment Plant Effluent Discharge."

5. Seal each sample container in a resealable plastic bag; label the bags with date, time, and sample identification; and place the bags in the cooler with ice if necessary.

6. Repeat Steps 2 through 5 as necessary to collect a volume sufficient to fill all of the required sample containers.

7. Complete the chain of custody form.

VI. Procedure for Collecting Samples for Field Parameters

The procedure for collecting the grab samples for measurement of field parameters is described below.

1. Complete Water Treatment Plant Effluent Discharge form.

2. Put on a new pair of disposable gloves.

3. Open sample tap and fill glass jar with adequate sample volume.

4. Measure pH. Two readings will be made and the average will be recorded in the field notebook and on the form.

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Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site – Twelvemile Creek Restoration

Closure and Post-Closure Care Plan

March 2010

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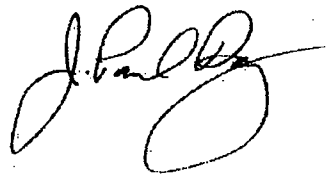

John Paul Doody, P.E.
South Carolina P.E. Number 26698

Closure and Post-Closure Care Plan

Prepared for:
Schlumberger Technology Corporation

Prepared by:
ARCADIS
6723 Towpath Road
Syracuse
New York 13214-0066
Tel 315.446.9120
Fax 315.449.0017

Local Office:
ARCADIS
30 Patewood Drive, Suite 155
Greenville
SC 29615

Our Ref.:
MT001019

Date:
March 2010

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Appendices

1. Background

Schlumberger Technology Corporation owns and operates the Sangamo Weston/Twelvemile Creek/Lake Hartwell PCB Contamination Superfund Site, Sediment Management Unit (SMU) for the permanent storage of sediment from the removal of Woodside I and Woodside II dams.

2. Closure

Operators of Class 3 landfills must install a final cover system that is designed to minimize infiltration and erosion. The final cover system for the SMU will be the prescribed cap described in Regulation 61-107.19, SWM: Solid Waste Landfills and Structural Fill, dated May 23, 2008, published by the South Carolina Department of Health and Environmental Control (DHEC).

The regulations require that the final cover system for a Class 3 landfill be designed and constructed to:

1. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-7} centimeters per second (cm/sec), whichever is less.

2. Minimize infiltration through the closed SMU by the use of an infiltration (bridging) layer that contains a minimum 18 inches of earthen material.

3. Minimize erosion of the final cover by the use of an erosion layer that contains a minimum 24-inches of earthen material that is capable of sustaining native plant growth.

The final cap at the SMU will consist of a minimum of 18 inch bridging layer of compacted material, a geosynethic clay layer (GCL), a 40 mil LLDPE liner, a geocomposite drainage layer, and a 24-inch thick erosion layer. The material for the bridging layer will be selected from the sediment for liner system support or from an on-site borrow area. The erosion layer will be 24-inch thick of vegetative layer that will be capable of sustaining plant growth. The maximum slope of the waste grades will not exceed 33 percent. The finished grade of the final cap will be between 3-5% on top slopes and side slopes will not exceed 33%, in accordance with R.61-107.19,Part V, Subpart F, Section 258.60. Drawings for the closure of the SMU are provided in Appendix A.

2.1 Estimate of Largest Area Requiring Cover

The area of the limits of sediment within the SMU is approximately 12 acres. No portion of the SMU has been closed as of January 2010. The entire SMU will be closed in one construction event currently scheduled for the fall of 2010.

2.2 Estimate of Maximum Inventory of Waste on Site

The Soil Management Unit is currently under construction and will be filled with sediment dredged from Woodside I and Woodside II impoundments, along with excess dam demolition material. The current estimated volume of sediment to be dredged from Woodside I and Woodside II impoundments is 500,000 cy. Closure activities will start once select materials from the dam demolition have been placed in the soil management unit. Once the SMU is closed, a summary report will be prepared, including an estimate of the quantity of sediment contained in the SMU on site. The report will be submitted to DHEC and placed in the landfill operating record.

2.3 Property Identification

Upon final closure of the entire area, Schlumberger Technology Corporation will prepare an accurate legal description of the property and the SMU boundaries. This information will be recorded on the property deed in the Pickens County Courthouse. Confirmation that this has been accomplished will be submitted to the Director of DHEC along with Notice of Final Closure.

2.4 Final Cover

Soil for final cover will be obtained from the site. Grading will be completed to minimize run-on and runoff. The final cover will be constructed and tested in accordance with the Quality Assurance/Quality Control (QA/QC) section of this report.

2.5 Grassing Schedule

Vegetation will be planted on the final cover material for erosion control purposes. The components of the vegetative cover in waste areas will be as follows:

Fertilizer	10-10-10 at 1,000 lbs/acre
Lime	3,000 lbs/acre

Table 1 – Seeding Schedule

Area	Sowing Season	Grass Species	Pure Live Seed (lbs)
Permanent			
All	3/1 – 8/14	Common Bermuda (hulled)	30
All	3/1 – 8/14	Weeping Lovegrass	10
All	3/1 – 8/14	Sericea Lespedeza (unscarified)	50
Temporary			
All	8/15 – 2/28	Common Bermuda (unhulled)	40
All	8/15 – 2/28	Weeping Lovegrass	10
All	8/15 – 2/28	Sericea Lespedeza (unhulled, unscarified)	80
All	8/15 – 2/28	Reseeding Crimson Clover	20
All	8/15 – 2/28	Rye Grain	20

Mulch fiber or straw will be used as needed after seeding. Seeding efforts may be modified and will be continued until an acceptable stand of grass is obtained on the disturbed areas. Seeding will be completed in the fall to the extent practical to obtain the maximum germination rate.

2.6 Equipment Needed

Final cover will be placed with standard earth-moving equipment, e.g., bulldozer and scraper. A vibrating roller will be used to compact the soil to meet permeability standards as described previously.

2.7 Erosion and Sedimentation Control

Erosion will be controlled primarily with vegetation. Within one month of final cover placement, Schlumberger Technology Corporation will grass the SMU in accordance with the seeding schedule in Table 1.

Until the grass is established, erosion will be controlled with silt fencing, temporary sediment traps, and sediment ponds, as required. Silt fencing will be installed at the toes of slopes around the perimeter of the SMU without established vegetation as needed, and diversion dikes will be constructed at the tops of slopes. Once vegetation

is established, temporary sediment traps, sediment ponds, and silt fence will be removed so that drainage from the SMU is not impeded.

2.8 Closure Schedule

The SMU will be closed in a single phase. Table 2 lists the steps involved in closing the phases of the SMU.

Table 2 – Closure Schedule

Closure Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Complete Final Filling (Time 0 Days)												
Notify Department NOI to Close SMU Has Been Placed in Operating Record												
Begin Closure Construction												
Construct Surface Water Management Structures												
Prepare Subgrade												
Place Final Cover												
Cover Vegetation												
Certify/Place in Operating Record												
Obtain Deed Notification												
Submit Notification to DHEC												

2.9 Construction Quality Assurance (CQA) Requirements

The final cover placement of the SMU will consist of a bridging layer, a geosynethic cover system (geosynetic clay layer (GCL), a 40 mil LLDPE liner, a geocomposite drainage layer), and an erosion layer capable of sustaining native plant growth.

The following describes the testing requirements for the placement of the bridging layer and erosion layer.

Borrow Material Testing

Various tests will be conducted on any new borrow soils, if required, to determine the suitability of the material and to identify the relationship between moisture content and compactive effort for the selected material. The test results will be submitted to the engineer for review. Only borrow material meeting the requirements will be approved for use in the project. Borrow material will not be transported until approved by the engineer. The soil material will be fine-grained material suitable for the construction of the final cap system. The material will be primarily clay- and silt-sized particles with the limited particle ranging up to 3 inches. The material will not have any vegetation, debris, sticks, deleterious material, or chemical contamination.

The material will be tested using the standards and methods described in Table 3.

Bridging Layer

The bridging layer will be placed immediately above the sampling sediment of the landfill. The 18-inch bridging layer of the SMU cap will be formed entirely of the select sediment materials that meet soil specifications. The material will be placed in a maximum of 8-inch pre-compacted lifts and will be free of organic and foreign material. It will be free of rocks and particles 3 inches or larger in diameter. Before proceeding with the next lift, each lift will be compacted to a minimum 90 percent standard Proctor at a maximum post-compaction thickness of 6 inches. Before proceeding with the next lift, the surface of the previous lift will be roughened with on-site equipment and wetted slightly to improve bonding between lifts. Surface wetting and roughening will be accomplished without compromising the overall integrity of the previous in-place lift. The finished grade of the final cap will be between 3-5% on top slopes and side slopes will not exceed 33%, in accordance with R.61-107.19,Part V, Subpart F, Section 258.60.

The contractor will provide moisture control as required to prevent desiccation cracking of the cap material. The final lift may be overbuilt by several inches to provide additional moisture control, and the excess material may be bladed off to final grade just before the cap is installed provided the infiltration layer meets the requirements listed in this manual. QA/QC testing will be performed during placement of the bridging layer according to the requirements outlined in Table 3.

Table 3 – Final Constructed Bridging Layer Testing Requirements

Testing	Minimum Frequency	Minimum Criteria
Density – Nuclear, Sand Cone*, or Drive-Cylinder (ASTM D-2922, ASTM D-1556, and ASTM D-2937)	4/acre/lift	≥ 90% Standard Proctor
Water Content (ASTM D-2216) (ASTM D-3017 or ASTM D-4643)	4/acre/lift (minimum one test per day)	+/- 3% Optimum
Construction Oversight	Continuous	Observation

Note:

1. The sand cone (ASTM D-1566) is required in the event that the liner is to be constructed with soils having more than 20% retained on No. 4 sieve.

To monitor and control the moisture content and dry density, QA/QC activities will be conducted. Moisture and density relationships will be developed based on previous test results of the on-site soils. A minimum of four density and moisture tests per acre per lift performed. The top of the bridging layer will be surveyed following placement, compaction, and grading of the layer to confirm thickness, elevations, and slopes are in accordance with the drawings.

Geosynethic Cover System

The Geosynethic Cover System consists of a GCL, a 40 mil LLDPE liner and a geocomposite drainage layer. The GCL properties will be confirmed with the manufacturer's roll certification testing. The revised specification for the GCL in the cover system is included in Appendix B. The LLDPE liner will have a series of product and seam welding QA/QC procedures as outlined in the project specifications. The geocomposite drainage properties will be confirmed with the manufacturer's roll certifications.

Erosion Layer

The 24-inch erosion layer will be constructed of material that is capable of sustaining native plant growth. The erosion layer will be constructed immediately on top of the geocomposite drainage layer. Seeding, mulching, and installation of other soil erosion control measures will be accomplished as soon as practical. QA/QC testing will be performed during placement in accordance with Table 4.

Table 4 – QA/QC Testing of the Erosion (Vegetative) Layer

Test	Frequency
Moisture Content of the Soil During Placement	Visual Observation
Density of Compacted Fill	Visual Observation
Grain Size/Maximum Particle Size	Visual Observation
Lift Thickness	Measurement and Visual Observation

Following placement and compaction of the erosion layer, a survey of the layer will be performed to confirm the thickness (24 inches) of the layer.

Acceptability

After documentation and drawings have been provided, the engineer will perform a final walking review of the site to ascertain that all phases of the project have been constructed according to the plans and specifications. The engineer will certify to the owner and DHEC that the project has been completed in accordance with the approved drawings and specifications and will request final acceptance.

2.10 Closure Certification

Upon completion of all requirements specified to close the facility outlined in the closure plan, Schlumberger Technology Corporation will provide a certification signed by a professional engineer registered in the state of South Carolina verifying compliance with the closure requirements. A copy of all Construction Quality Assurance test records and documentation will also be provided. This certification will be provided to DHEC within 90 days of the termination of closure activities. After DHEC issues final cover approval, Schlumberger Technology Corporation will record notation to deed with the appropriate authority.

3. Post-Closure

The landfill will receive post-closure care as described below for a period of 30 years. The facility will be inspected at least every 90 days and after every 24-hour, 25-year storm event. Action will be taken to repair or correct any problems.

The point of contact for this facility during the post-closure period will be:

Mr. George Maulouf

Rogers and Callcott

426 Fairforest Way

Greenville, SC 29607

3.1 Post-Closure Use of the Property

Schlumberger Technology Corporation currently has no plans for post-closure use of the SMU property. The site will be maintained as an open grassed area. Other on-site activities of Schlumberger Technology Corporation will not affect the final cap or ongoing monitoring activities associated with the SMU. DHEC will be notified of any change in post-closure use of the property.

3.2 Water Quality Monitoring Schedule

Monitoring and sampling will be conducted in accordance with the "Groundwater Monitoring Plan, dated March 2010. Schlumberger Technology Corporation will monitor the groundwater at the SMU quarterly for one year and semi-annually thereafter using five groundwater monitoring wells. Groundwater monitoring data will be submitted to DHEC within 30 days of reporting results. An annual report will be provided to summarize the monitoring results from each year. This report will be submitted to DHEC following the final sampling event of the year and will include the data from that event.

3.3 Methane Gas Monitoring

The sediments stored in the SMU are not expected to generate methane. Therefore, no methane collection or monitoring was designed. However, based on the materials observed during sediment placement contingencies may be applied. These could

include a "rain flap"-type construction in the liner that would keep rain water out while allowing gas to escape to the geocomposite and vent to a central location(s).

3.4 Monitoring Responsibility

Schlumberger Technology Corporation or its designated representative will be responsible for conducting all groundwater monitoring. At any time the monitoring results indicate exceeding of established standards or indicate a threat to human health or the environment, Schlumberger Technology Corporation will notify DHEC within five days of such determination and will provide a plan for remediation within 30 days of such notice. The plan will be submitted to the DHEC for approval.

3.5 Leach Water Collection and Treatment

Leach water will be pumped from the sump in the cell to two 10,000 gallon storage tanks. These tanks will be emptied into transfer trucks and the leach water taken offsite for treatment. The tanks will have level sensors and a dialing system to indicate when water levels in the tanks require attention. Additionally, the system will be constructed within a 20-foot by 40-foot concrete pad to provide secondary containment. This pad will be constructed to contain approximately 10,500 gallons, or approximately one-half of the total tank storage capacity. The tanks, along with the associated sensors and other systems, will be visually inspected concurrently with other regular onsite inspection and maintenance activities. Maintenance and repairs will be performed as necessary.

The average leachate volume for years 1 through 30 were determined by a Hydrologic Evaluation of Landfill Performance (HELP) model run for the final capped SMU (Appendix C). The HELP model estimates 300 gallons of leachate would be generated on average per year. Based on typical EPA leachate generation rate estimates, between approximately 100 and 200 gallons per day would be appropriate for this size SMU; that would generate between 36,500 gallons and 73,000 gallons per year representing a much more conservative estimate than the HELP model output identifies.

We estimated that the observed leachate generation rate may be as high as 100,000 gallons per year initially with a reduction to 10,000 gallons per year in later years. This rate is still more conservative than the HELP model estimate.

3.6 Sediment Basin Maintenance and Cleanout

The sediment basins will be cleaned of sediments when the sediments reach the clean-out levels as indicated on the sediment gage in the ponds. A dredge, clamshell bucket, or other appropriate equipment will be used to clean the ponds.

3.7 SMU Access

Access to the SMU will be blocked with a locked gate after final closure. Permanent signs will be posted along the closed areas to indicate the limits of waste.

3.8 Routine Inspection of Vegetative/Final Cover/Drainage Systems and Maintenance

Schlumberger Technology Corporation will inspect the SMU at least quarterly with monthly inspections the first year. The inspections will include the following:

1. Check slopes for erosion. Fill and grass any rills or gullies.

2. Check down drains, storm drains and ponds for clogging or damage.

3. Check for settling, subsidence, or erosion of the cover material.

Any deficiencies will be promptly corrected, either by repair or replacement, to maintain the integrity of the final cover. Provisions will be made to mow the final cover periodically during the growth season and maintain areas damaged by erosion Maintenance will also include reseeding and maintaining fertilization of areas with poor or no grass growth.

3.9 Closure and Post-Closure Operating and Maintenance Cost Estimate

Schlumberger Technology Corporation has prepared a copy to estimate the yearly and total cost over 30 years to monitor the site. The cost components include the cost to close the facility as presented in Section 2 (Table 1) and post-closure activities discussed in Section 3 (Tables 2 through 6).

The Closure and Post-Closure Operating and Maintenance Cost Estimate is included in Appendix D.

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Appendix A

Record Drawings (to be provided upon completion)

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Appendix B

Revised Technical Specification
Section 02413 – Geosynthetic
Clay Liner

SECTION 02413

GEOSYNTHETIC CLAY LINER (GCL)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Geosynthetics Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the installation of all GCL layers as shown on the Drawings.

B. GCL will be installed as part of the landfill Baseliner and Final Cover Systems construction. The following technical specifications present requirements for the manufacturing, testing, transport, storage and installation of the GCL.

1.2 REFERENCES

A. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing.

C. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

D. ASTM D4873 – Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.

E. ASTM D5887 – Standard Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.

F. ASTM D5888 – Standard Guide for Storage and Handling of Geosynthetic Clay Liners.

G. ASTM D5889 – Standard Practice for Quality Control of Geosynthetic Clay Liners.

H. ASTM D4643 – Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

I. ASTM D5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

J. ASTM D5890 – Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

K. ASTM D5891 – Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

L. ASTM D5993 – Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners.

M. ASTM D6243 – Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method (with the following clarifications):
   1. For interface shear test, test GCL with materials which will be installed above and below the GCL (i.e., GCL/separation layer interfaces).
   2. All specimens and interfaces shall be fully hydrated for at least 24 hours, under 200 psf normal stress.
   3. Tests shall be performed at normal loads of 1,000, 2,500, and 3,500 psf with a minimum displacement of 2 in.

N. ASTM D 6495 – Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners.

O. ASTM D 6496 – Standard Test Method for Determining Average Bonding Peel Strength between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.

P. ASTM D 6768 – Standard Test Method for Tensile Strength of Geosynthetic Clay Liners.

Note: The most current version of the specified test method should be followed by the MANUFACTURER, Geosynthetics Contractor or authorized testing laboratory.

1.3 DEFINITIONS

A. Minimum Value – Property value representing the lowest individual allowable result when tested according to the specified test method. This applies to individual readings such as thickness or for tests where only one specimen is tested for the specific parameter.

B. Minimum Average Value – Property value representing the lowest allowable value for the reported average of specimens tested for the specified parameter.

C. Minimum Average Roll Value (MARV) – Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any sample taken during quality assurance will exceed the value reported.

D. Nominal Value – Property value that is representative of a measurable property, determined under a set of prescribed test conditions, by which a product may be described.

E. Typical Roll Value – Property value calculated from average or mean obtained from test data.

1.4 SUBMITTALS

A. The Geosynthetics Contractor shall submit to the Engineer the following items:
   1. Prior to Delivery to the Site:
      a. A project reference list demonstrating the Geosynthetics Contractor's experience on a minimum of 5 projects consisting of 10 million square feet of installed GCL, or as approved by the Owner.
      b. A list of all GCL installation crew personnel and resumes of the Supervisor and QC Manager including prior experience installing GCL. This information shall be

submitted at least 30 days prior to the commencement of GCL installation. If the exact crew who will be performing the installation is not known 30 days in advance of the start date, the Geosynthetics Contractor shall submit a list of several potential crew members. This information shall be supplied in a timely manner for approval in order to avoid delay of any construction activities. GCL crew staff will be subject to approval by the Owner.

c. A copy of the MANUFACTURER's Manufacturing Quality Assurance/ Manufacturing Quality Control (MQA/MQC) Plan for testing GCL.
d. A statement of the GCL MANUFACTURER's experience in manufacturing GCL, including the manufacturing and supplying company's name, address, and employee contact.
e. A certification from the GCL MANUFACTURER attesting that the proposed GCL meets the physical, mechanical and manufacturing requirements specified in Part 2 of this Section.
f. Copies of the Manufacturing Quality Control (MQC) certificates for the material to be delivered to the site. The reports shall include the quality control test results of samples obtained during the manufacturing of the material to be delivered to the site. The GCL will be rejected if it does not meet the specified requirements of Part 2 of this Section or if it is found to have defects, rips, holes, flaws, deterioration or other damage deemed unacceptable by the Engineer.
g. A certification from the manufacturer that the manufacturing process used to produce the GCL includes needle detection and a mechanism for removal of needles. The certification shall include a statement attesting that the needle detection and removal process will be applied to all GCL supplied to this project, and that all GCL rolls shall be needle free.
h. Summary report including results of MQC testing required by this Section for GCL material to be delivered to the site. The report must clearly demonstrate that the GCL material to be delivered to the site meets the requirements of Part 2 of this Section.
i. Proposed method of GCL panel seaming including overlap distance at sides and end of panels, and use of additional material to complete the seal (if any).
j. Proposed method of detection of needles in installed panels.
k. Internal and interface shear strength test results as required in Part 2, Article 2.01, Paragraph C and/or D of this Section.

2. Prior to Installation:
   a. A schedule of operations including means and methods of installation.
   b. The proposed method of deploying material and placement of panels.
   c. Proposed method or process by which adjacent panels will be joined to provide a continuous hydraulic barrier.
   d. Shop drawings including details of all overlapping attachments and anchoring.
   e. Proposed method of protecting installed GCL panels from rain, ponding water or other elements that could hydrate or damage the GCL.
3. During Installation Submitted Weekly:
   a. Weekly construction progress reports clearly showing GCL panels and GCL roll numbers placed by date.
4. Upon Completion:
   a. Record Panel Layout Diagram.

b. Summary and log of all laboratory quality control and quality assurance completed by GEOSYNTHETIC Contractor.
c. Summary and log of all field quality control work completed by the Geosynthetics Contractor.
d. Certification that GCL installation is complete and in accordance with these specifications.
e. Statement of material and installation warranties.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Geosynthetics Contractor shall be responsible for the protection of the GCL against damage during transportation to the site, during storage and installation at the site, and prior to placement of subsequent construction materials.

B. GCL labeling, shipment, and storage shall follow ASTM D4873 and D5888, as modified according to this Section.

C. Product labels shall clearly show the manufacturer or supplier name, style name, roll number and roll dimensions.

D. If any special handling is required, it shall be so marked on the outside surface of the wrapping, (e.g., Do not stack more than three rolls high).

E. The GCL shall be supplied dry (unhydrated, less than 20% moisture content) and be delivered to the site undamaged.

F. Each GCL roll shall be wrapped with a material that will protect the bentonite from moisture and the GCL from damage due to shipment, water, sunlight and contaminants.

G. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the packaging shall be immediately repaired and/or roll tarped to prevent potential additional hydration. The roll shall be set aside and marked for closer inspection upon deployment. Sections of the roll may be rejected if the moisture content of the bentonite has become excessively high as determined by the Engineer.

H. Storage area should be relatively flat and well drained. During storage, the GCL rolls shall be elevated off the ground utilizing a method which will not damage the GCL. Material that is damaged as a result of the method of storage or handling shall be rejected and replaced at no additional cost to the Owner. The GCL rolls shall be adequately covered to protect them from the following:
1. Site construction damage.
2. Precipitation and ponded water.
3. Chemicals that are strong acids or bases.
4. Flames or sparks, temperatures in excess of 49°C (120°F).
5. Any environmental condition that might damage the GCL.

I. The GEOSYNTHETIC Contractor shall protect the work described in this Section before, during and after installation. Only non-damaged, sufficiently dry material (as determined by the Engineer) shall be included within the construction.

J. Roll numbers on partially used rolls shall be maintained such that each GCL roll number can be readily identified just prior to GCL deployment.

K. If the Engineer determines that GCL is damaged, the Geosynthetics Contractor shall make all repairs and replacements in a timely manner to prevent delays in the progress of work. Any material damaged by the Geosynthetics Contractor, or damaged by others due to improper delivery, installation and/or storage, as determined by the Engineer, shall be replaced by the Geosynthetics Contractor at no cost to the Owner.

1.6 QUALITY ASSURANCE SAMPLING, TESTING AND ACCEPTANCE

A. Geosynthetic Clay Liner Material

1. The GCL shall be subject to sampling and testing to verify conformance with this specification.
2. Samples shall be taken across the entire width of the GCL roll. Unless otherwise specified or permitted by the Engineer, samples shall be three feet long by the roll width. The engineer or authorized representative shall mark the machine direction on the samples with an arrow. Unless otherwise specified, samples shall be taken at a frequency of one per 100,000 ft2 of material delivered to the site. An appropriate number of samples as determined by the Engineer will be shipped directly to the Geosynthetics QAL. The Engineer shall examine the material properties required by this Section against all results from laboratory conformance testing. Non-conforming material will be rejected and bracketed from subsequent rolls from the same product lot.
3. Conformance testing shall be the responsibility of the Owner and conducted by the Geosynthetics QAL. Conformance testing shall be conducted in accordance with ASTM D6495 but shall include the following parameters:
   a. Hydraulic Conductivity (ASTM D5887 – 1 test per 250,000 square feet).
   b. Mass per Unit Area of Bentonite (ASTM D5993).
   c. Mass per Unit Area Upper and Lower Layer Geotextile (ASTM D5261).
   d. Bentonite Moisture Content (ASTM D4643).
   e. Index Flux of GCL (ASTM D5887).
   f. Grab Tensile Strength of GCL (ASTM D4632).
4. The Geosynthetics Contractor shall, at no additional cost to the Owner, provide whatever reasonable assistance the Engineer may require in obtaining the samples for conformance testing.
5. The Geosynthetics Contractor and the Engineer shall provide MQC data issued by the manufacturer prior to site delivery of the GCL. In the event the material is delivered prior to receipt of the manufacturer's quality control certificates, the GCL without quality control certificates will be stored separate from GCL with quality control certificates. GCL rolls with unacceptable quality control data shall be segregated from approved material and marked for rejection.
6. Internal and interface shear strength testing of the GCL is the responsibility of the Owner. All testing must be conducted prior to approval and delivery of the GCL material and

performed with components that will be used in construction. GCL material must meet the requirements of Part 2, Article 2.01, Paragraph C of this Section.

PART 2 MATERIALS

2.1 GENERAL

A. The GCL shall consist of a low permeability sodium bentonite encapsulated between two geotextiles. The bentonite and finished product requirements are described in the following Parts and include the minimum MQA and MQC testing.

B. The Geosynthetics Contractor shall obtain a certificate from the GCL manufacturer for MQC testing described in this Part.

C. GCL MATERIAL – The Engineer shall obtain six random samples of the proposed GCL (three each for the Baseliner and Final Cover Systems) and materials that will be installed above and below the GCL for the Baseliner and Final Cover Systems. These samples will undergo interface shear strength testing for the interface. Condition shown on the Construction Drawings.

Additionally, six random samples of the proposed GCL (three each for the Baseliner and Final Cover Systems) shall be submitted for testing of internal shear strength. All testing must be conducted prior to the approval and delivery of the materials and performed with components that will be used in the construction. Testing shall be conducted according to the most recent version of ASTM D6243, test preparations shall be in accordance with Paragraph C.1 of this Part and the reported results shall meet the requirements of Paragraph C.2 of this Part.

1. All specimens and interfaces shall be hydrated under a normal load of 200 psf for a minimum period of 24 hours prior to shearing at a strain rate of 0.04 in./min.
2. Tests for both internal and interface shear strength shall be performed at normal loads of 1,000, 2,500 and 3,500 psf with a minimum displacement of 2 in. The required peak shear strength for each of the interfaces is provided in the table below.

GCL Interface and Internal Shear Strength (ASTM D6243) Frequency of 1 test per product type.	
GCL – Normal Stresses (psf)	Required Peak Shear Strength Value (psf)*
1,000	270
2,500	670
3,500	940

* The required shear strengths above include both internal friction and cohesion (adhesion) components.

2.2 BENTONITE

A. The bentonite used for the production of the GCL shall be low permeability sodium bentonite.

B. The bentonite portion of the GCL shall be granular bentonite.

C. The supplier and/or source of the bentonite shall be included on the MQA results for the bentonite.

2.3 GEOSYNTHETIC CLAY LINER

A. The GCL shall consist of a low permeability sodium bentonite encapsulated between two geotextiles.

B. The following table represents the minimum required MQC testing that must be conducted by the GCL MANUFACTURER on the GCL. The GCL shall be tested in accordance with ASTM D5889 as modified by the following table. Testing shall be conducted at the frequencies listed in the following table and must meet the required values provided:

2.4 GEOSYNTHETIC CLAY LINER

A. CETCO Bentomat ST is the recommended Geosynthetic Clay Liner, alternatives must meet the following characteristics and test frequencies, as approved by the Engineer.
   1. Bentonite property tests performed must be performed at a bentonite processing facility before shipment to production facility.

CETCO Bentomat ST Properties and Testing Specifications			
Material Property	Test Method	Test Frequency ft^2 (m^2)	Required Values
Bentonite Swell Index	ASTM D5890	1 per 50 tonnes	24 ml/2g min.
Bentonite Fluid Loss	ASTM D 5891	1 per 50 tonnes	18 ml max.
Bentonite Particle Size	ASTM C 136	1 per 50 tonnes	5% max retained #10 1% max passing #200
Bentonite Mass/Area	ASTM D 5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.6 kg/m^2)
GCL Tensile Strength	ASTM D 6768	200,000 ft^2 (20,000 m^2)	30 lbs/in (53N/cm) MARV
GCL Peel Strength	ASTM D 6496	40,000 ft^2 (4,000 m^2)	3.5 lbs/in 6.1 N/cm) min
GCL Index Flux	ASTM D 5887	Weekly	1 x 10^{-8} m^3/m^2/sec max
GCL Hydraulic Conductivity	ASTM D 5887	Weekly	5 x 10^{-9} cm/sec max
GCL Hydrated Internal Shear Strength	ASTM D 5321 ASTM D6243	Periodic	500 psf (24 kPa) typ @ 200 psf

PART 3 EXECUTION

3.1 SITE PREPARATION

A. The surface to be covered by the GCL shall be scarified to a minimum depth of six inches and cleared of sharp objects, boulders, rocks, sticks, or any materials that may puncture, shear, or tear the GCL. The GCL subgrade shall have a smooth, finished surface, free from pockets, holes, ruts and depressions that will cause bridging and overstress the material to the judgment of the Engineer.

B. The GEOSYNTHETIC Contractor and Engineer shall inspect the subgrade for unsuitable areas or soft spots before the GCL is placed. Additional surface preparation will be required to eliminate any unsuitable areas as determined by the Engineer.

C. The subgrade/geosynthetic surface below the GCL shall:
   1. Be prepared in accordance with the Plans and Specifications.
   2. The final surface will be rolled with a smooth drum roller prior to GCL deployment.
   3. For GCL deployment over soil surfaces, the prepared soil surface shall have no stones or other protrusions that may be damaging to the GCL as determined by the Engineer.
   4. Be approved, accepted and certified by the Engineer and Geosynthetics Contractor's quality assurance inspector.

3.2 INSTALLATION

A. GCL shall not be deployed during periods of excessive winds which could prevent an acceptable installation as determined by the Engineer.

B. All GCL materials shall be installed according to the grades and locations presented in the Construction Drawings and in accordance with manufacturer's recommendations.

C. The Geosynthetics Contractor shall furnish the roll number and panel number to the Engineer prior to the installation of each panel.

D. The Geosynthetics Contractor shall maintain the GCL in an "as received" condition up to and including the time that the overlying layer of the Baseliner/Final Cover System is accepted by the Owner. While the GCL will begin to hydrate immediately upon deployment, it is essential that the GCL not become fully hydrated prior to loading, as placement of material over hydrated bentonite may destabilize a given area. The GCL must have a minimum of 1 foot of general fill in place prior to full hydration. Additional restrictions and guidance with regard to hydrated or wet GCL are as follows:
   1. GCL shall not be placed on wet subgrade, as determined by the Engineer.
   2. GCL becoming partially hydrated prior to covering with general fill shall be evaluated by the Engineer to ascertain the condition of the material and to determine if removal and replacement is necessary.
   3. In the event that full hydration occurs prior to placement of the overlying materials described above, the GCL material shall be evaluated by the Engineer to ascertain the condition of the material and to determine if removal is necessary. Full hydration in this case shall be defined as a bentonite moisture content of 80% or more.

E. The Contractor is required to place cover materials described in Part 3.2, Paragraph D as quickly as possible after deployment of GCL. The time period between deployment of GCL and cover materials shall not exceed 20 days. This period of time may be extended, at the discretion of the Engineer, in the event the Geosynthetics Contractor can adequately demonstrate that the GCL does not hydrate above 50% moisture prior to placement of the cover materials.

F. Each panel shall be checked for the presence of broken needles from the manufacturing process according to the approved method submitted by the Geosynthetics Contractor. All

identified needles must be removed by the Contractor at no cost to the Owner. Any panel or roll exhibiting the presence of excessive amounts of broken needles shall be rejected and removed at no additional cost to the Owner. Excessive amounts of broken needles will be determined by the Engineer.

G. Geosynthetic Contractor personnel shall not be allowed to wear shoes that can damage the GCL during deployment or placement of subsequent geosynthetic materials.

H. GCL Panels shall be deployed in a direction from the highest elevation to the lowest elevation within the area to be lined. Whenever possible, GCL panels shall be staggered such that cross seams between panels are not continuous throughout the lined area. GCL panels shall be installed free of tension.

I. GCL seams shall be overlapped a minimum of 6 in. on edge seams and minimum of 12 in. on end seams after shrinkage and before placing cover.

J. The Geosynthetics Contractor shall not deploy more GCL in one day than can be covered by end of that day with overlying materials.

K. The GCL rolls shall be handled in a manner that minimizes loss of bentonite along edges during deployment.

L. The Geosynthetics Contractor shall be responsible for protection of the GCL during installation. Unless otherwise approved by the Engineer, no rubber tire ATV's, tracked vehicles or any other equipment which may pose a risk of puncturing, tearing or otherwise damaging the GCL shall be permitted for use directly over the GCL.

M. The GCL shall not be covered until inspected and approved by the Engineer. Field observations shall include a visual check of in-place GCL for the presence of needles.

3.3 REPAIRS

A. Repairs are to be made as soon as possible following deployment of GCL panels.

B. Damage to the GCL shall be repaired in the following manner, unless alternate procedures are proposed by the Geosynthetics Contractor and reviewed by the Engineer.
   1. The damaged area shall be cleared of dirt and debris.
   2. A patch of GCL shall be cut to extend a minimum of 12 in. beyond the damaged area in all directions.
   3. Granular bentonite shall be placed around the perimeter of the damaged area at a rate of 0.25 pounds per linear foot.
   4. The patch shall be placed over the damaged area and may be secured with an adhesive to keep the patch in position during backfilling or other activities over the GCL. The adhesive shall be approved by the GCL MANUFACTURER and the Engineer.

PART 4 QUALITY CONTROL

4.1 GENERAL

A. The Geosynthetics Contractor, before installation begins, shall appoint an experienced individual who will be on-site at all times during the installation, to represent the Geosynthetics Contractor in all matters to this work. This appointment shall be subject to approval by the Owner.

B. All of the forms specified and required must be submitted in a timely fashion.

C. Any changes in the proposed method of work, subcontractors to be utilized, GCL or manufacturing must be approved in advance by the Owner. The Geosynthetics Contractor assumes all responsibility relevant to providing an acceptable product.

4.2 QUALITY CONTROL DURING MANUFACTURING

A. The MANUFACTURER shall sample and test the GCL according to Part 2 of this Section to verify consistency of production and compliance with these specifications. Testing shall be in accordance with the test methods and at the frequencies specified in Part 2 of this Section.

B. The manufacturing process shall include a mechanism for needle detection and removal. This mechanism shall be in operation throughout the production of all GCL rolls to be delivered to the site. The manufacturer shall issue a certification listing all rolls with which the mechanism was utilized as well as a certification that all material supplied is needle-free.

C. The Geosynthetics Contractor shall provide the Engineer with certified copies of MQA/MQC test results. No material shall be installed prior to supply and approval of the required test results.

D. The Engineer may obtain additional random samples of the GCL for further confirmatory testing. This testing will be at the expense of the Owner, unless the test reveals the GCL does not comply with the specifications, in which case the expense of the testing will be the responsibility of the Geosynthetics Contractor. This testing may include all properties specified in Part 2 of this Section or other tests deemed reasonable and necessary by the Engineer. The Geosynthetics Contractor shall, however, at no additional cost, provide whatever reasonable assistance the Engineer may require in obtaining the samples.

E. The Geosynthetics Contractor shall be solely responsible for the quality of the material provided. Should any tests performed on the material yield unsatisfactory results, the Geosynthetics Contractor will be responsible for replacing the material with materials that meet project specifications without delay to the project and at no additional cost to the Owner.

4.3 QUALITY CONTROL DURING INSTALLATION

A. The Engineer and the Geosynthetics Contractor shall visually inspect all material to be included in the work for damage incurred during transportation and for uniformity, and

compare roll identification numbers with those on the certification provided by the manufacturer to assure delivery of the appropriate material.

B. The Engineer and Geosynthetics Contractor shall also visually inspect the material for any damage incurred as a result of handling or on-site storage.

C. Damage to GCL during installation shall be repaired according to Part 3.03 of this Section. If the Engineer determines that the damage is considered un-repairable, the damaged material will be replaced at no additional cost to the Owner.

D. Prior to installation, the Engineer will select three random samples for internal shear strength and interface shear strength for each interface described in Part 2, Article 2.01, Paragraph C and/or D of this Section. Internal and interface shear strength testing will be at the expense of the Owner, unless the tests reveal that the GCL does not comply with the specifications, in which case, the expense of the tests on failing material will be incurred by the Geosynthetics Contractor. No material shall be installed before the internal and interface shear test results show that the GCL meets the project specifications.

E. The Geosynthetics Contractor is responsible for verifying that the GCL is free of needles during both manufacturing and installation. If needles are detected or suspected by the Engineer, the Owner may require the Geosynthetics Contractor to provide verification, at no additional cost to the Owner, that installed GCL does not contain needles that could possibly damage the geomembrane.

END OF SECTION

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Appendix C

HELP Model Output

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                 HELP MODEL VERSION 3.07 (1 November 1997)                 **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                     USAE WATERWAYS EXPERIMENT STATION                     **
**                FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                           **
**                                                                           **
*******************************************************************************
*******************************************************************************


PRECIPITATION DATA FILE:     C:\WHI\UNSAT22\data\P318.VHP\_weather1.dat
TEMPERATURE DATA FILE:       C:\WHI\UNSAT22\data\P318.VHP\_weather2.dat
SOLAR RADIATION DATA FILE:   C:\WHI\UNSAT22\data\P318.VHP\_weather3.dat
EVAPOTRANSPIRATION DATA:     C:\WHI\UNSAT22\data\P318.VHP\_weather4.dat
SOIL AND DESIGN DATA FILE:   C:\WHI\UNSAT22\data\P318.VHP\I_386048.inp
OUTPUT DATA FILE:            C:\WHI\UNSAT22\data\P318.VHP\O_386048.prt


TIME:  17: 1     DATE:   9/30/2009


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     TITLE:  Scenario B (GCL)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
               COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.
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LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 8

THICKNESS	=	30.48	CM
POROSITY	=	0.4630	VOL/VOL
FIELD CAPACITY	=	0.2320	VOL/VOL
WILTING POINT	=	0.1160	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.370000000000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 4.63
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.00	CM
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.8500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	0.50	PERCENT
DRAINAGE LENGTH	=	22.9	METERS

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.10	CM
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.400000000000E-12	CM/SEC
FML PINHOLE DENSITY	=	2.00	HOLES/HECTARE
FML INSTALLATION DEFECTS	=	2.00	HOLES/HECTARE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 55

THICKNESS	=	0.50	CM
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3980	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000000000E-08	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1219.20	CM
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.150000000000E-03	CM/SEC

LAYER 6

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	60.96	CM
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000000000E-01	CM/SEC
SLOPE	=	0.50	PERCENT
DRAINAGE LENGTH	=	22.9	METERS

LAYER 7

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.10	CM
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.200000000000E-12	CM/SEC
FML PINHOLE DENSITY	=	2.00	HOLES/HECTARE
FML INSTALLATION DEFECTS	=	2.00	HOLES/HECTARE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 55

THICKNESS	=	0.50	CM
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3980	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000000000E-08	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 0.% AND A SLOPE LENGTH OF 23. METERS.

SCS RUNOFF CURVE NUMBER	=	73.46	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	0.4047	HECTARES
EVAPORATIVE ZONE DEPTH	=	22.9	CM
INITIAL WATER IN EVAPORATIVE ZONE	=	10.584	CM
UPPER LIMIT OF EVAPORATIVE STORAGE	=	10.584	CM
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.652	CM
INITIAL SNOW WATER	=	0.000	CM
INITIAL WATER IN LAYER MATERIALS	=	248.904	CM
TOTAL INITIAL WATER	=	248.904	CM
TOTAL SUBSURFACE INFLOW	=	0.00	MM/YR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM Asheville NC

STATION LATITUDE	=	35.59	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	96	
END OF GROWING SEASON (JULIAN DATE)	=	298	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.60	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	75.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	84.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR Asheville NC

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.48	3.60	5.13	3.84	4.19	4.20
4.43	4.79	3.96	3.29	3.29	3.51

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR Asheville NC

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
36.80	39.10	46.40	55.70	63.30	69.80
73.20	72.60	66.90	56.00	46.40	39.30

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR Asheville NC
AND STATION LATITUDE = 34.82 DEGREES

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 30 and their dates (DDDYYYY)

	(INCHES)	(CU. FT.)	
PRECIPITATION	3.66	13285.51042	3220012
RUNOFF	2.932	10643.76346	3220012
DRAINAGE COLLECTED FROM LAYER 2	0.05152	187.00785	3240009
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000005	0.01956	3240009
AVERAGE HEAD ON TOP OF LAYER 3	12.001		
MAXIMUM HEAD ON TOP OF LAYER 3	14.279		
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	58.8 FEET		
DRAINAGE COLLECTED FROM LAYER 6	0.00000	0.01467	560010
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002	560010
AVERAGE HEAD ON TOP OF LAYER 7	0.001		
MAXIMUM HEAD ON TOP OF LAYER 7	0.002		
LOCATION OF MAXIMUM HEAD IN LAYER 6 (DISTANCE FROM DRAIN)	0.2 FEET		
SNOW WATER	6.34	23023.4682	3590013

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4630
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1160

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas

ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

ARCADIS

Appendix D

Closure and Post-Closure Operation and Maintenance Cost Estimate

TABLE 1
CLOSURE COST ESTIMATE

SCHLUMBERGER TECHNOLOGY CORPORATION
TWELVEMILE CREEK RESTORATION
PICKENS COUNTY, SOUTH CAROLINA

Cap System					
1.	Drainage Geocomposite Supply	540,000	SF	$0.46	$248,400
2.	Drainage Geocomposite Installation	540,000	SF	$0.14	$75,600
3.	40 mil LLDPE Liner Supply	540,000	SF	$0.40	$216,000
4.	40 mil LLDPE Linder Installation	540,000	SF	$0.17	$91,800
5.	24" Soil Erosion Layer	40,000	CY	$8.39	$335,600
6.	Clay Cap	30,000	CY	$17.38	$521,400
7.	Down Drains	600	LF	$80.32	$48,192
8.	Seeding/Mulch	25	AC	$1,888.16	$47,204
9.	Construction Supervision and Documentation	1	LS	$80,000.00	$80,000
				Subtotal	**$1,664,196**
				Contingency (5%):	**$83,210**
				Total Cost:	**$1,747,406**
				Total Cost (Rounded):	**$1,700,000**

SF - Square Foot
CY - Cubic Yard
LF - Linear Foot
AC - Acre
MO - Month

General Comments:

- Unit costs are in 2010 dollars and were derived from Weston Solutions, Inc. bid costs to perform the work.
- All costs include material and labor unless otherwise noted.
- Costs do not include legal fees, permitting, negotiations, or agency oversight.
- Costs based on current site information and project understanding. Costs may change following collection of additional data.
- A 5% contingency has been applied to the bid costs to account for potential changes during construction. This portion of the project is under contract and little variance is anticipated rom the contracted cost.

TABLE 2
POST-CLOSURE OPERATION AND MAINTENANCE ESTIMATED TOTAL COST

SCHLUMBERGER TECHNOLOGY CORPORATION
TWELVEMILE CREEK RESTORATION
PICKENS COUNTY, SOUTH CAROLINA

Annual Total Cost (Rounded)	$150,000	$100,000	$90,000	$90,000
Number of Years	1	1	8	20
Time Range Total	$150,000	$100,000	$720,000	$1,800,000
Total Cost	**$2,770,000**			
Total Cost (Rounded)	**$2.8 M**			

TABLE 3
POST-CLOSURE ANNUAL OPERATION AND MAINTENANCE COST ESTIMATE - YEAR 1

SCHLUMBERGER TECHNOLOGY CORPORATION
TWELVEMILE CREEK RESTORATION
PICKENS COUNTY, SOUTH CAROLINA

Inspection and Maintenance					
1.	Landscaping	2	EVENT	$5,000	$10,000
2.	Routine Inspections	12	EVENT	$1,000	$12,000
3.	Sediment Pond Upkeep	1	LS	$10,000	$10,000
4.	Leachate Transportation & Treatment	6	EVENT	$2,500	$15,000
5.	Maintenance and Miscellaneous Repairs	1	LS	$20,000	$20,000
				Subtotal:	**$67,000**
Sampling					
6.	Labor	4	EVENT	$2,500	$10,000
7.	Direct Costs	4	EVENT	$1,000	$4,000
8.	Analytical Laboratory - Groundwater	4	EVENT	$4,000	$16,000
9.	Analytical Laboratory - Surface Water	4	EVENT	$800	$3,200
10.	Reporting	4	EVENT	$8,000	$32,000
				Subtotal	**$65,200**
				Subtotal	**$132,200**
				Contingency (15%):	**$19,830**
				Annual Total Cost:	**$152,030**
				Annual Total Cost (Rounded):	**$150,000**

LS - Lump Sum

General Comments:

- In providing opinions of probable construction costs, the Client understands that the design professional has no control over costs; the price of labor, equipment, or materials; or the construction contractor's methods of pricing. The opinions of probable construction costs provided herein are to be made on the basis of the Design Professional's qualifications and experience. The Design Professional makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs. This cost estimate is expected to be within -10% to +10% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such; this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.

- All costs include material and labor unless otherwise noted.
- Costs do not include legal fees, permitting, negotiations, or agency oversight.
- Unit costs are in 2010 dollars and were derived from standard and accepted estimate references (e.g., Means Site Work and Landscape Cost Data, vendors, professional judgment, and/or past experience on other similar projects).
- Costs based on current site information and project understanding. Costs may change following collection of additional data.

Notes and Assumptions:

1. Includes the cost of mowing, fertilizing and other general landscape upkeep.
2. Includes labor cost for one local field technician for 1 day (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes monthly inspections.
3. Includes cost of cleaning and maintaining the sediment ponds.
4. Includes cost to transport (via truck) and treat stored leachate. Assumes a treatment cost of $0.10 per gallon. Assumes inspection, maintenance, and repairs to leachate collection system will occur during routine inspection and maintenance visits. Assumes approximately 100,000 gallons of leachate per year based on the HELP model and EPA minimum criteria.
5. Includes the cost of maintaining and repairing landfill systems including the landfill cap, perimeter fence, and signage. Includes costs to control animals including installation/maintenance of engineering controls and animal relocation.
6. Includes labor cost for two local field technicians for 1.5 days (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes quarterly sampling events.
7. Includes the cost of shipping, copies, and various sampling equipment. Assumes quarterly sampling events.
8. Assumes 5 groundwater sampling wells and analytical laboratory costs of $800 per well per sampling event. Assumes quarterly sampling events.
9. Assumes 1 surface water sample and $800 per sample per sampling event. Assumes quarterly sampling events conducted concurrently with the groundwater sampling.
10. Includes $12,000 (shown as $3,000 per event) to process, review, summarize, and report data collected during the first three quarterly inspection and sampling events. Includes $20,000 (shown as $5,000 per event) to prepare and submit an annual data summary report after the fourth quarterly inspection and sampling event.

TABLE 4
POST-CLOSURE ANNUAL OPERATION AND MAINTENANCE COST ESTIMATE - YEAR 2

SCHLUMBERGER TECHNOLOGY CORPORATION
TWELVEMILE CREEK RESTORATION
PICKENS COUNTY, SOUTH CAROLINA

Inspection and Maintenance					
1.	Landscaping	2	EVENT	$5,000	$10,000
2.	Routine Inspections	4	EVENT	$1,000	$4,000
3.	Sediment Pond Upkeep	1	LS	$10,000	$10,000
4.	Leachate Transportation & Treatment	5	EVENT	$2,000	$10,000
5.	Maintenance and Miscellaneous Repairs	1	LS	$20,000	$20,000
				Subtotal:	**$54,000**
Sampling					
6.	Labor	2	EVENT	$2,500	$5,000
7.	Direct Costs	2	EVENT	$1,000	$2,000
8.	Analytical Laboratory - Groundwater	2	EVENT	$4,000	$8,000
9.	Analytical Laboratory - Surface Water	2	EVENT	$800	$1,600
10.	Reporting	2	EVENT	$7,500	$15,000
				Subtotal	**$31,600**
				Subtotal	**$85,600**
				Contingency (15%):	**$12,840**
				Annual Total Cost:	**$98,440**
				Annual Total Cost (Rounded):	**$100,000**

LS - Lump Sum

General Comments:

- In providing opinions of probable construction costs, the Client understands that the design professional has no control over costs; the price of labor, equipment, or materials; or the construction contractor's methods of pricing. The opinions of probable construction costs provided herein are to be made on the basis of the Design Professional's qualifications and experience. The Design Professional makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs. This cost estimate is expected to be within -10% to +10% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such; this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.

- All costs include material and labor unless otherwise noted.
- Costs do not include legal fees, permitting, negotiations, or agency oversight.
- Unit costs are in 2010 dollars and were derived from standard and accepted estimate references (e.g., Means Site Work and Landscape Cost Data, vendors, professional judgment, and/or past experience on other similar projects).
- Costs based on current site information and project understanding. Costs may change following collection of additional data.

Notes and Assumptions:

1. Includes the cost of mowing, fertilizing and other general landscape upkeep.
2. Includes labor cost for one local field technician for 1 day (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes quarterly inspections.
3. Includes cost of cleaning and maintaining the sediment ponds.
4. Includes cost to transport (via truck) and treat stored leachate. Assumes a treatment cost of $0.10 per gallon. Assumes inspection, maintenance, and repairs to leachate collection system will occur during routine inspection and maintenance visits. Assumes treatment of approximately 80% of the volume treated in year 1.
5. Includes the cost of maintaining and repairing landfill systems including the landfill cap, perimeter fence, and signage. Includes costs to control animals including installation/maintenance of engineering controls and animal relocation.
6. Includes labor cost for two local field technicians for 1.5 days (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes semi-annual sampling events.
7. Includes the cost of shipping, copies, and various sampling equipment. Assumes semi-annual sampling events.
8. Assumes 5 groundwater sampling wells and analytical laboratory costs of $800 per well per sampling event. Assumes semi-annual sampling events.
9. Assumes 1 surface water sample and $800 per sample per sampling event. Assumes semi-annual sampling events conducted concurrently with the groundwater sampling.
10. Includes $4,000 (shown as $2,000 per event) to process, review, summarize, and report data collected during the first semi-annual inspection and sampling event. Includes $10,000 (shown as $5,000 per event) to prepare and submit an annual data summary report after the second semi-annual inspection and sampling event.

TABLE 5
POST-CLOSURE ANNUAL OPERATION AND MAINTENANCE COST ESTIMATE - YEARS 3-10

SCHLUMBERGER TECHNOLOGY CORPORATION
TWELVEMILE CREEK RESTORATION
PICKENS COUNTY, SOUTH CAROLINA

Inspection and Maintenance					
1.	Landscaping	2	EVENT	$5,000	$10,000
2.	Routine Inspections	4	EVENT	$1,000	$4,000
3.	Sediment Pond Upkeep	1	LS	$5,000	$5,000
4.	Leachate Transportation & Treatment	3	EVENT	$2,000	$6,000
5.	Maintenance and Miscellaneous Repairs	1	LS	$21,000	$21,000
				Subtotal:	**$46,000**
Sampling					
6.	Labor	2	EVENT	$2,500	$5,000
7.	Direct Costs	2	EVENT	$1,000	$2,000
8.	Analytical Laboratory - Groundwater	2	EVENT	$4,000	$8,000
9.	Analytical Laboratory - Surface Water	2	EVENT	$800	$1,600
10.	Reporting	2	EVENT	$7,000	$14,000
				Subtotal	**$30,600**
				Subtotal	**$76,600**
				Contingency (15%):	**$11,490**
				Annual Total Cost:	**$88,090**
				Annual Total Cost (Rounded):	**$90,000**

LS - Lump Sum

General Comments:

- In providing opinions of probable construction costs, the Client understands that the design professional has no control over costs; the price of labor, equipment, or materials; or the construction contractor's methods of pricing. The opinions of probable construction costs provided herein are to be made on the basis of the Design Professional's qualifications and experience. The Design Professional makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs. This cost estimate is expected to be within -10% to +10% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such; this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.

- All costs include material and labor unless otherwise noted.
- Costs do not include legal fees, permitting, negotiations, or agency oversight.
- Unit costs are in 2010 dollars and were derived from standard and accepted estimate references (e.g., Means Site Work and Landscape Cost Data, vendors, professional judgment, and/or past experience on other similar projects).
- Costs based on current site information and project understanding. Costs may change following collection of additional data.

Notes and Assumptions:

1. Includes the cost of mowing, fertilizing and other general landscape upkeep.
2. Includes labor cost for one local field technicians for 1 day (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes quarterly inspections.
3. Includes cost of cleaning and maintaining the sediment ponds.
4. Includes cost to transport (via truck) and treat stored leachate. Assumes a treatment cost of $0.10 per gallon. Assumes inspection, maintenance, and repairs to leachate collection system will occur during routine inspection and maintenance visits. Assumes treatment of approximately 50% of the volume treated in year 1.
5. Includes the cost of maintaining and repairing landfill systems including the landfill cap, perimeter fence, and signage. Includes costs to control animals including installation/maintenance of engineering controls and animal relocation. Includes $5,000 for pump replacement every 5 years (shown as $1,000 per year).
6. Includes labor cost for two local field technicians for 1.5 days (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes semi-annual sampling events.
7. Includes the cost of shipping, copies, and various sampling equipment. Assumes semi-annual sampling events.
8. Assumes 5 groundwater sampling wells and analytical laboratory costs of $800 per well per sampling event. Assumes semi-annual sampling events.
9. Assumes 1 surface water sample and $800 per sample per sampling event. Assumes semi-annual sampling events conducted concurrently with the groundwater sampling.
10. Includes $4,000 every year (shown as $2,000 per event) to process, review, summarize, and report data collected during the first semi-annual inspection and sampling event. Includes $10,000 every year (shown as $5,000 per event) to prepare and submit an annual data summary report after the second semi-annual inspection and sampling event.

TABLE 6
POST-CLOSURE ANNUAL OPERATION AND MAINTENANCE COST ESTIMATE - YEARS 11-30

SCHLUMBERGER TECHNOLOGY CORPORATION
TWELVEMILE CREEK RESTORATION
PICKENS COUNTY, SOUTH CAROLINA

Inspection and Maintenance					
1.	Landscaping	2	EVENT	$5,000	$10,000
2.	Routine Inspections	4	EVENT	$1,000	$4,000
3.	Sediment Pond Upkeep	1	LS	$5,000	$5,000
4.	Leachate Transportation & Treatment	1	EVENT	$2,000	$2,000
5.	Well Replacement	1	LS	$3,125	$3,125
6.	Maintenance and Miscellaneous Repairs	1	LS	$21,000	$21,000
				Subtotal:	**$45,125**
Sampling					
7.	Labor	2	EVENT	$2,500	$5,000
8.	Direct Costs	2	EVENT	$1,000	$2,000
9.	Analytical Laboratory - Groundwater	2	EVENT	$4,000	$8,000
10.	Analytical Laboratory - Surface Water	2	EVENT	$800	$1,600
11.	Reporting	2	EVENT	$7,000	$14,000
				Subtotal	**$30,600**
				Subtotal	**$75,725**
				Contingency (15%):	**$11,359**
				Annual Total Cost:	**$87,084**
				Annual Total Cost (Rounded):	**$90,000**

LS - Lump Sum

General Comments:

- In providing opinions of probable construction costs, the Client understands that the design professional has no control over costs; the price of labor, equipment, or materials; or the construction contractor's methods of pricing. The opinions of probable construction costs provided herein are to be made on the basis of the Design Professional's qualifications and experience. The Design Professional makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs. This cost estimate is expected to be within -10% to +10% of the actual project cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. ARCADIS is not licensed to provide financial or legal consulting services, as such; this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability reserves.

- All costs include material and labor unless otherwise noted.
- Costs do not include legal fees, permitting, negotiations, or agency oversight.
- Unit costs are in 2010 dollars and were derived from standard and accepted estimate references (e.g., Means Site Work and Landscape Cost Data, vendors, professional judgment, and/or past experience on other similar projects).
- Costs based on current site information and project understanding. Costs may change following collection of additional data.

Notes and Assumptions:

1. Includes the cost of mowing, fertilizing and other general landscape upkeep.
2. Includes labor cost for one local field technician for 1 day (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes quarterly inspections.
3. Includes cost of cleaning and maintaining the sediment ponds.
4. Includes cost to transport (via truck) and treat stored leachate. Assumes a treatment cost of $0.10 per gallon. Assumes inspection, maintenance, and repairs to leachate collection system will occur during routine inspection and maintenance visits. Assumes treatment of approximately 10% of the volume treated in year 1.
5. Includes the cost of removing and reinstalling groundwater monitoring wells, if necessary. Includes a one-time cost of $12,500 per well for 5 wells incurred during Years 11 through 30 (shown as $3,125 per year).
6. Includes the cost of maintaining and repairing landfill systems including the landfill cap, perimeter fence, and signage. Includes costs to control animals including installation/maintenance of engineering controls and animal relocation. Includes $5,000 for pump replacement every 5 years (shown as $1,000 per year).
7. Includes labor cost for two local field technicians for 1.5 days (10 hrs) at $70/hr, the cost of a rental car and gas, and the cost of meals. Assumes semi-annual sampling events.
8. Includes the cost of shipping, copies, and various sampling equipment. Assumes semi-annual sampling events.
9. Assumes 5 groundwater sampling wells and analytical laboratory costs of $800 per well per sampling event. Assumes semi-annual sampling events.
9. Assumes 1 surface water sample and $800 per sample per sampling event. Assumes semi-annual sampling events conducted concurrently with the groundwater sampling.
10. Includes $4,000 every year (shown as $2,000 per event) to process, review, summarize, and report data collected during the first semi-annual inspection and sampling event. Includes $10,000 every year (shown as $5,000 per event) to prepare and submit an annual data summary report after the second semi-annual inspection and sampling event.

ADDENDUM TO
STORMWATER POLLUTION PREVENTION PLAN (SWPPP)
TWELVE MILE CREEK RESTORATION

Tax Map #4067-15-64-0880 (WSI, 4067-00-11-7623 (WSII) and 4067-00-45-4040 (Ball West SMU) Pickens County Permit # 39-18-09

Pickens County, South Carolina

Prepared for:

Schlumberger

SCHLUMBERGER TECHNOLOGY CORPORATION

300 Schlumberger Drive, Sugar Land, TX 77478

Revision	Description	Date
1	**Address Pickens County Comments dated 2/3/10**	**2/12/10**

Prepared by:

WESTON SOLUTIONS, INC.
5430 Metric Place, Suite 100
Norcross, Georgia 30092

WESTON SOLUTIONS
an employee-owned company

February 2010

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Section **Page**

Attached Figures:

Figure 1 - SWPPP Addendum Area

Figure 2 - SWPPP For Work Near Twelvemile Creek

Figure 3 - SWPPP For Work Adjacent to Twelvemile Creek

LIST OF ACRONYMS AND ABBREVIATIONS

BMPs	Best Management Practices
CWA	Clean Water Act
EPP	Environmental Protection Plan
MSDS	Material Safety Data Sheets
PCB	Polychlorinated biphenyl
NPDES	National Pollutant Discharge Elimination System
SCDHEC	South Carolina Department of Health and Environmental Control
SCGPSWDLSCA	South Carolina General Permit for Storm Water Discharges from Large and Small Construction Activities SCR100000
SCHLUMBERGER	Schlumberger Technology Corporation
SMU	Sediment Management Unit
SWPPP	Stormwater Pollution Prevention Plan
WESTON®	Weston Solutions, Inc.
WSI	Woodside I Dam
WSII	Woodside II Dam

1. INTRODUCTION

1.1 PURPOSE AND OBJECTIVE

Weston Solutions, Inc. (WESTON®) has been tasked by the Schlumberger Technology Corporation (SCHLUMBERGER) to complete the 12 Mile Creek Restoration project in Pickens County, South Carolina. The purpose of this Stormwater Pollution Prevention Plan (SWPPP) is to provide measures that will be implemented during this project to mitigate and monitor the release of pollutants associated with the construction activities.

1.2 SITE DESCRIPTION

Twelvemile Creek is located in the Piedmont physiographic province within upstate South Carolina. Approximately 24 miles long, the creek begins near Walnut Cove Mountain at an elevation of approximately 1,900 ft. Twelvemile Creek flows to its confluence with Lake Hartwell near the City of Clemson. There are 3 impoundments located approximately 1 to 2 miles upstream of backwater impacts from high Lake Hartwell water levels. The lower two compounds that set for demolition, Woodside I (WSI) and Woodside II (WSII) are former hydroelectric facilities.

The existence of Woodside I and Woodside II reportedly made it difficult for the natural flow of sediment into Lake Hartwell. Historically the trapped sediment was flushed during power generation, but with the dams no longer in the use normal processes were not adhered. The polychlorinated biphenyls on the site were deemed a hazard by the Georgia and South Carolina departments of Natural Resources, the USACE, and the US Fish and Wildlife Services.

The purpose of the Twelvemile Creek project is to remove the accumulated sediment, decontaminate the existing PCBs, and demolish WSI and WSII to return the natural flow of the water. The site location can be found on Page 1-3 of this work plan.

1.3 IMPLEMENTATION

The SWPPP was submitted to Pickens County and the state of South Carolina by ARCADIS, the measures implemented prior to the actual commencement of construction activities. The initial

element of the (WESTON) SWPPP addendum to be completed is the training and education program to ensure that appropriate project personnel are aware of the stormwater pollution management program. The recommended control measures are then maintain, constructed and installed as required depending on the phase of construction. WESTON will administer the program outlined in the ARCADIS SWPPP until construction is completed. If ongoing construction involves a change in ownership, the new owner must accept, maintain, and amend this SWPPP as required.

Site Location

REFERENCE: BASE MAP USGS 7.5 MINUTE QUADRANGLE., SIX MILE, S.C., 1961, PHOTOREVISED 1980

LOCATION MAP

0 2000' 4000'

GRAPHIC SCALE

AREA LOCATION

SOUTH CAROLINA

2. PROJECT LOCATIONS AND DESCRIPTION

2.1 SOILS INFORMATION

During soil disturbing construction activities it is important to understand the nature and behavior of different soil types. Soil characteristics can affect stormwater runoff and infiltration, slope requirements for excavation activities, and stabilization procedures. Soil data for the construction site has been provided by the Final Design Report Amendment 1 by ARCADIS under section 2.5 and Appendix C. This data was used by ARCADIS during the design process to design the necessary measures. These measures are further discussed in detail in section 4.

2.2 POTENTIAL POLLUTANTS

The potential pollutants in the construction area consists of PCB's, hydraulic oil, diesel, gasoline, vehicle and equipment lubricants and spray paint. The Material Safety Data Sheets (MSDS) of these potential pollutants have been provided under separate cover to SCHLUMBERGER as part of the Accident Prevention Plan.

2.3 SOIL DISTURBING ACTIVITIES

Soil-disturbing activities at the site will consist of constructing, access roads & ramps and laydown areas. Dam removal and dredging in the creek will also disturb the underwater sediment and increase the turbidity in water flowing downstream.

2.4 SCHEDULE OF SOIL-DISTURBING ACTIVITIES

Construction of entrances/exits, parking areas and access roads & ramps are expected to take approximately 4 weeks to complete after mobilization. Mobilizing the dredging equipment is expected to take about 4 weeks and the dredging activity is expected to take about 5 months. The mobilization and setup for each dam removal is expected to take 30 days, the actual dam removal is expected to take another 30 days and the restoration is expected to take 7 days. The demolition of the WSI and WSII is planned to be executed concurrently. The dredging and dam removal will commence after the new access roads & ramps are complete. These work activities are expected to run in parallel.

3. EROSION AND SEDIMENT CONTROL PRACTICES

3.1 DURING CONSTRUCTION

3.1.1 Temporary Erosion and Sediment Control

Temporary erosion and velocity control measures, such as staked silt fence (wire backed or silt saver type), will be installed by another subcontractor prior to WESTON arriving on site. Wherever necessary a double layered silt fence will be used on both sides of access ramps and roads by WESTON during the mobilization and construction process. These measures will contain disturbed soils on the construction site, and minimize the potential for upland soils to enter any wetlands or water bodies, if they are present. If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize off-site impacts.

Temporary erosion and sediment controls will be properly maintained throughout construction and reinstalled, as specified in section 3.3 "Sediment and Erosion Controls" of Final Design Report Amendment 1 by ARCADIS, until replaced by permanent erosion and sediment controls or restoration is complete. Specifications of silt fences and straw bales for erosion control are provided in Appendix D.

3.1.2 Erosion Controls at SMU and Staging Areas

Double layered silt fence will be located on both sides of the ramp connecting the SMU access road to the existing Balls Beach Road. Further details of this are shown in Figures 1 and 2. A check dam will be installed downstream of the 18" pipe, made from onsite natural rocks. The mulch from the grinding operation was placed between the double silt fences. Approximately 300 feet down the existing road to Ball's Beach, a silt fence is installed across the road to limit potential runoff to the stream.

At the Ball's Beach location, Weston proposes to install temporary gravel pad (used as a crane pad for launching and retrieving the dredge) constructed of geotextile and stone. The stone pad is planned to be approximately 150-feet long by 50-feet wide. Class B Rip-Rap will be installed to stabilize the slope near the water's edge. Additional silt fence will be installed, as necessary,

Layout of the dredge piping and water treatment discharge line are presented in Figure 3. Little or no land disturbance is expected during installation of these lines. Basically, the lines will be installed in the woods by gravity and removed by pulling them upslope from the SMU area.

3.1.3 Turbidity Control During Dredging

WESTON and its subcontractors will take all necessary measures to keep turbidity levels at a minimum during dredging operations including the use of siltation barriers or turbidity curtains as necessary. The turbidity curtains will be located at a minimum of just upstream of WSI and WSII dams. The dredging and the sampling activities will be performed by the subcontractors under the strict supervision of WESTON.

WESTON and its subcontractors shall use a portable nephelometer that meets Environmental Protection Agency and SCDHEC standards to measure turbidity. The nephelometer will be factory calibrated within the last one year. A skiff boat will be used to conduct sampling. The turbidity data will be analyzed and reported in accordance with the water quality monitoring requirements specified in SCR100000 General construction permit and all other applicable standards.

Turbidity Monitoring Reports and Charts will be submitted to SCHLUMBERGER daily as part of Contractors Quality Control Report. Date shall be reported in Nephelometric Turbidity Units (NTU's) and also the date and time of calibration, sample collection and sample analysis; water depth; sample depth; DGPS position; weather conditions; tidal stage; current direction and wind direction and velocity. Sampling locations, current direction, and plume configuration will also be noted. In the event that the turbidity exceeds 50 NTU above the reading measured upstream, the Contractor shall immediately cease dredging activities and notify the Owner. Corrective measures will be undertaken repeat the sampling analysis until the turbidity has returned to acceptable levels. Samples will be taken one foot below the water surface unless directed otherwise by the Owner. Two samples will be taken daily one upstream of the work area and the other downstream of WSII dam.

All data will be recorded on the Turbidity Monitoring Reports. The nephelometer shall be calibrated immediately prior to each sampling event. The time of each calibration shall be

recorded. Orion Dredging Services' authorized technician shall attest to the accuracy of the reported data, testing equipment and procedure by signing and dating the Turbidity Monitoring Report.

In addition to the contractor turbidity sampling, Schlumberger will employee up to three stationary monitoring units in the creek with continuous monitoring at up to 15 minutes intervals.

3.1.4 Turbidity Control During Dam Removal

The access road to WSI will be perpendicular to the creek. The contractor will enhance the existing access road for loading/unloading the dredge, as necessary to facilitate the operation. A small staging area at the top of the bank will be used to load the dam demolition material into road trucks. Skeleton buckets will be used just downstream of both the dams so as to capture any construction debris from flowing in to the stream.

Subcontractor intends to recycle all demolition materials generated as creek restoration material, in the SMU for erosion protection or offsite, if necessary. The location of the offsite recycling facilities is tentative.

During the removal of dam WSI, no turbidity curtains will be used as dredging will be in progress downstream, where the turbidity curtains will already be installed. Turbidity curtains will be installed as necessary while demolishing dam WSII.

3.1.5 Dust Control

Although dust should not be an issue with wet sediments, access roads and materials handling will be maintained with a water truck, as necessary, to control fugitive dust.

3.1.6 Pollution Control

Materials will be handled with a hydraulic dredge pumping creek sediments to the SMU for processing.

3.1.7 Potential Off-Site Pollution Sources

No potential off-site pollution sources have been identified.

3.2 RESTORATION

3.2.1 Cleanup

As construction activities are completed for this project, cleanup (seeding and installation of temporary or permanent erosion control structures) will be initiated in completed portions of the site as soon as practical and no later than 14 days after construction activities have temporarily or permanently ceased. Where construction activity on a portion of the site is temporarily ceased, and earth disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the site.

3.2.2 Permanent Erosion and Sediment Control

Permanent erosion and sediment control measures may be required as part of post-construction site restoration if the project crosses or lies adjacent to water bodies or wetlands, or is located on a significant slope. The need for permanent erosion and sediment controls will be determined by the WESTON Project Manager or Project Superintendent.

The following conditions apply to construction facilities permitted under the TPDES Construction General Permit:

- Final stabilization is not complete until an approximately uniform perennial vegetative cover with a density of at least 70% of the native background vegetative cover has been established for all areas subject to erosion.
- For construction on agricultural land, final stabilization on areas actually disturbed may be accomplished by returning the disturbed land to its preconstruction agricultural use. Disturbed areas near agricultural areas but not actually used for agricultural activities must meet the requirements for 70% stabilization in the preceding paragraph.

3.2.3 Re-vegetation

Natural local vegetation will be permitted to retake areas in which construction activities have ceased. If necessary, vegetation will be planted or transferred to encourage re-vegetation.

4. STORMWATER MANAGEMENT PRACTICES

This section of the SWPPP describes the construction management and operating procedures to be utilized for this project in order to minimize contact of construction materials, equipment, machinery and vehicles with stormwater, and to control potential pollutants and minimize their impact to stormwater discharges. Recommended practices are discussed in the following sections.

4.1 GENERAL RECOMMENDED PRACTICES

The following presents the recommended good housekeeping practices which are expected for compliance with the stormwater regulations. These practices are intended to reduce pollutant loading to stormwater and reduce non-stormwater discharges.

- Reduce tracking of sediment offsite
- Keep pollutant(s) off exposed surfaces
- Maintain low runoff velocities
- Minimize slope of disturbed areas
- Mark limits of grading to protect areas of existing vegetation
- Minimize the generation of wastes and dispose of them properly
- Prevent spills and leaks and respond to them immediately
- Properly store all materials

4.2 PRE-CONSTRUCTION CONTROL PRACTICES

The following presents the recommended pre-construction practices which are expected for compliance with the stormwater regulations:

- Delineate existing vegetation to be preserved and establish limits of grading.
- Maintain prefabricated board mats, roads, docks, and other work area improvements in a neat and clean condition reasonably free of loose soil, construction debris, and trash. Sweeping or other equally effective means shall be used on a regular basis to prevent storm flows from carrying sediment and debris outside the project boundaries.
- Install temporary erosion and sediment controls (such as sediment barriers and interceptor dikes) down gradient of the construction area and at other locations as necessary and deemed appropriate.

- Install velocity dissipation devices, as necessary, at discharge locations and along the length of any drainage ways to prevent significant changes in the hydrological regime (physical, chemical, and biological characteristics) of the receiving water body.

4.3 EROSION AND SEDEMENT CONTROL INSPECTION AND MAINTENANCE PRACTICES

The following inspection and maintenance practices will be used to maintain erosion and sediment controls. Section 8 of this SWPPP describes the required project site inspections in further detail.

- All construction areas will be inspected weekly. Observation and comments must be documented on a SWPPP Inspection Report Form.
- Erosion and sediment controls will be in place and inspected at the start of land disturbing construction activities. Following this initial inspection, all control measures will be inspected at least once every 14 calendar days during construction activities and within 24 hours after any storm event with a 0.5 inch or greater rainfall event. Observations and comments must be recorded on a Construction Site Inspection Form.
- All erosion and sediment control measures will be maintained in good working order. Any deficiencies identified on the Construction Site Inspection Form need to be promptly corrected before the next anticipated storm event, or as necessary to maintain the continued effectiveness of the erosion and sediment controls. If revisions to the SWPPP are necessary, they must be made within 7 days following an inspection. Continued deficiencies will be noted on subsequent inspections and the Project Manager and Project Superintendent shall be notified.

In accordance with the NPDES and SCDHEC general permits, the dates of major grading activities on the project site will be documented on the Activity Log (Appendix F).

A record of construction activity stops and restarts, and associated temporary or permanent stabilization measures, will be kept on the Activity Log. Stabilization measures, whether temporary or permanent, will be implemented within 14 days after construction activities have ceased. Where construction activity on a portion of the site is temporarily ceased, and earth disturbing activities will be resumed within 14 days, temporary stabilization measures do not have to be initiated on that portion of the site. Stabilization measures will be inspected at the start of stabilization, and weekly thereafter until the project is completed and the construction

site is closed. The Construction Site Inspection Form will be used to record the results of the inspection.

All completed forms will be kept on file with this SWPPP, and copies will be submitted to the Project Manager in accordance with the record keeping practices discussed in Section 8.5.

The Project Superintendent will be responsible for all inspections, maintenance, and repair activities. The Project Superintendent will complete and file the inspection and maintenance reports with this SWPPP at the project site.

5. WASTE MANAGEMENT AND DISPOSAL

Every effort will be made to minimize the generation of wastes. All solid or liquid wastes that may be generated during construction will be removed from the site on a timely basis and disposed of in a proper manner and in accordance with applicable federal, state or local regulations. No construction wastes will be buried on-site, and all personnel will be instructed in the correct procedures for waste disposal. Furthermore, no solid materials, including building materials, will be discharged to waters of the United States, except as authorized by a Section 404 permit. Under no circumstance will concrete trucks wash out directly into a drainage channel, storm sewer, or surface waters of the state.

All reasonable steps will be taken to minimize or prevent any discharge in violation of the SCDHEC general permit which has a reasonable likelihood of adversely affecting human health or the environment.

5.1 HAZARDOUS WASTES AND MATERIALS

All hazardous wastes will be disposed of in accordance with any applicable federal, state, or local regulations, as well as the manufacturer's guidelines, if any. Appropriate personnel will be instructed in proper use and disposal practices of such wastes and materials.

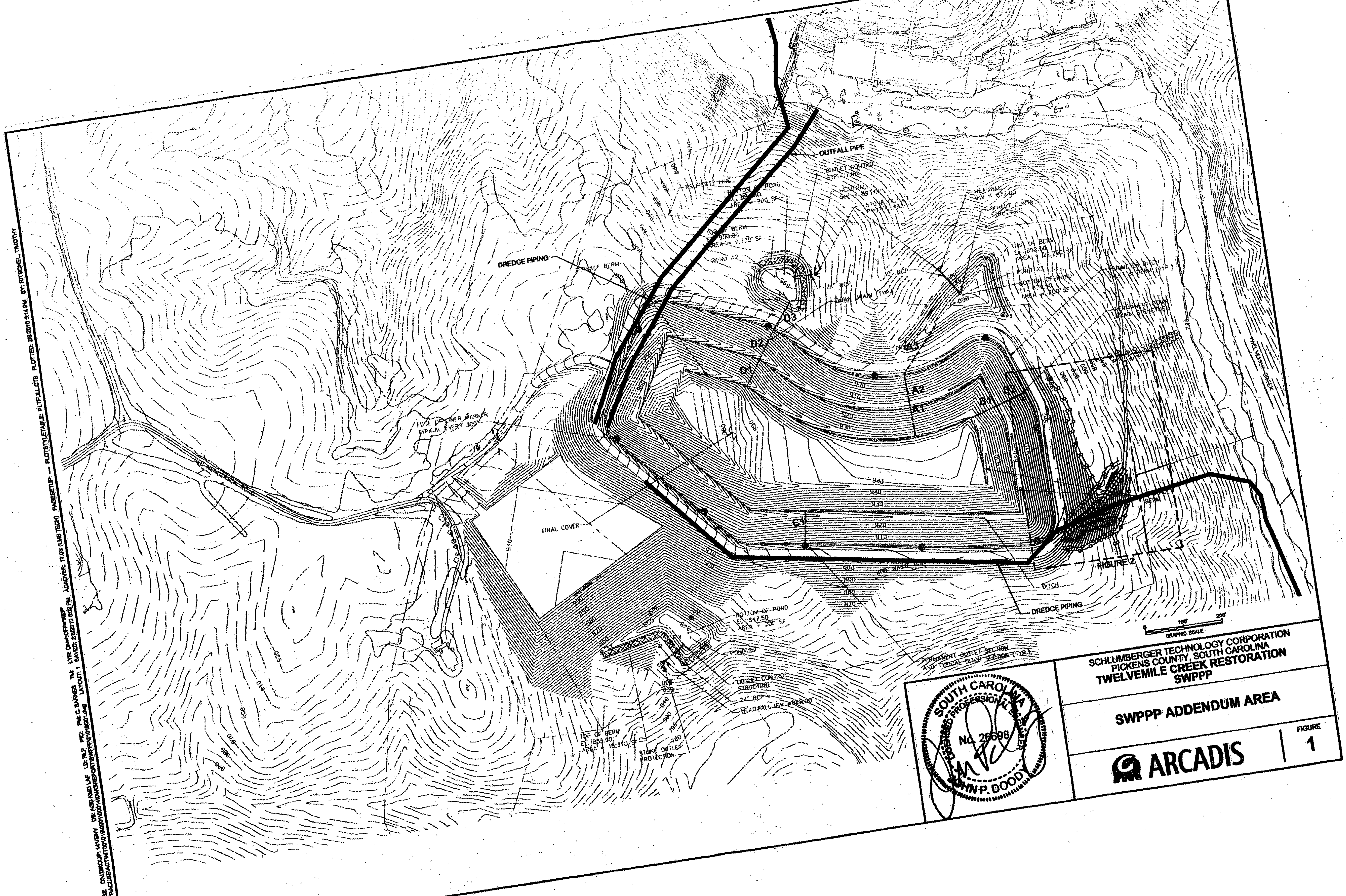
5.2 SANITARY WASTES

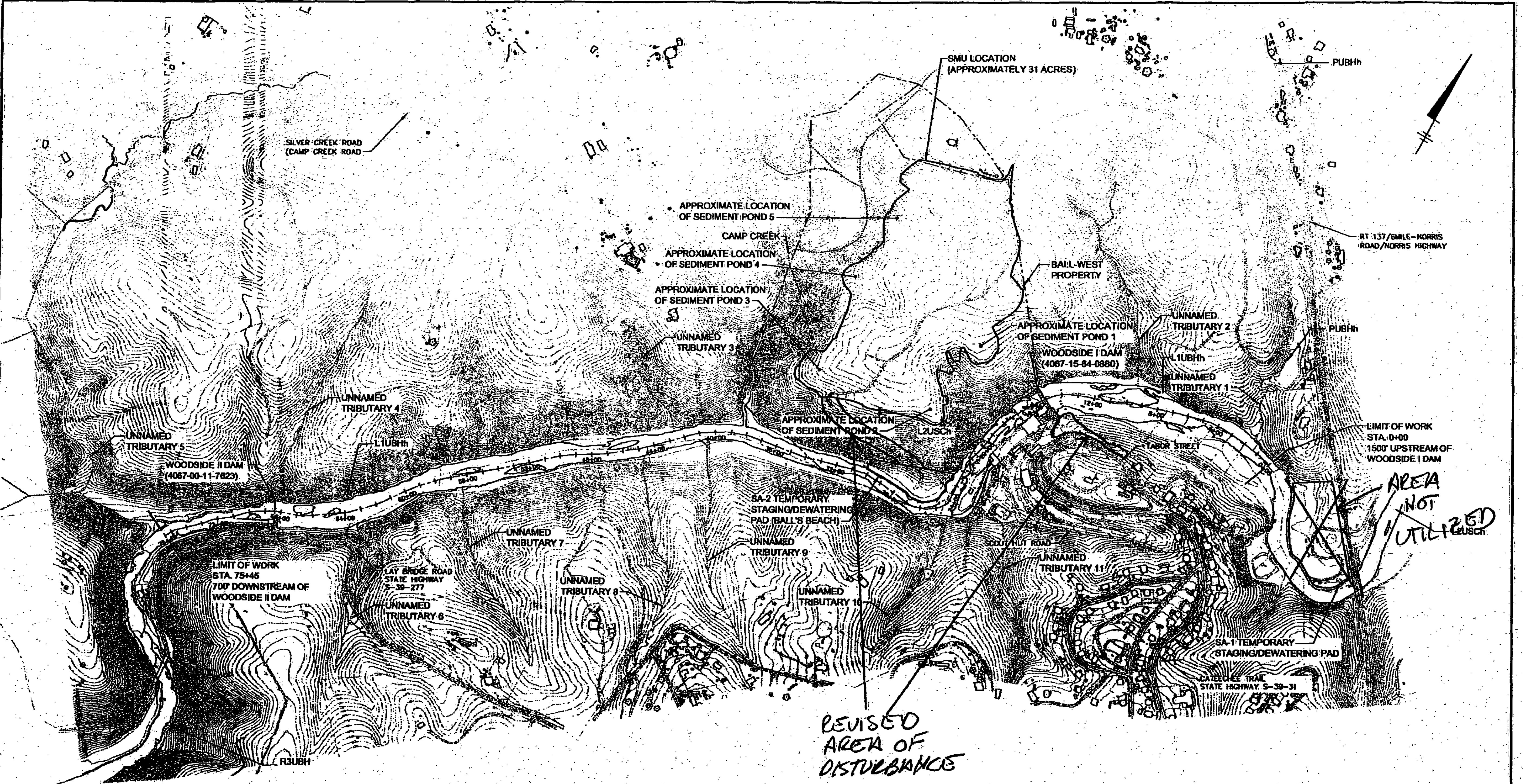
If portable sanitary units are to be on-site for this project, an adequate number of units will be located at the work site. A licensed sanitary waste management company will collect sanitary wastes from the portable units on a regular schedule.

5.3 GOOD HOUSEKEEPING FOR WASTE MANAGEMENT

The discharge of stormwater from the construction site will not cause a violation of the state water quality standards. No water containment, by itself of in combination with other substances, will prevent the waters of the state from meeting the following conditions:

- Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
- Waters shall be free from oil, scum, and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses
- Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses
- Waters shall be free from substances or conditions in sufficient amounts to have a harmful effect on human, animal, or aquatic life
- There shall be no significant human health hazard from incidental contact with the water
- There shall be no acute toxicity to livestock or wildlife watering
- Waters shall be free from physical, chemical, or hydrologic changes that would impair the natural biological community.
- Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles, or equipment and solid waste.


SCHLUMBERGER TECHNOLOGY CORPORATION
PICKENS COUNTY, SOUTH CAROLINA
TWELVEMILE CREEK RESTORATION
SWPPP
SWPPP ADDENDUM AREA
ARCADIS
FIGURE
1
SOUTH CAROLINA
LICENSED PROFESSIONAL ENGINEER
No. 26698
JOHN P. DOODY
GRAPHIC SCALE
0
100'
200'
OUTFALL PIPE
DREDGE PIPING
FINAL COVER
FIGURE 2
DITCH
TWELVEMILE CREEK
D3
D2
D1
A3
A2
A1
B1
B2
C1
BOTTOM OF POND
EL. 847.50
AREA = 200 SF
OUTLET CONTROL STRUCTURE
STONE OUTLET PROTECTION
PERMANENT OUTLET SECTION AND TYPICAL DITCH SECTION (TYP.)



LEGEND:

- EXISTING GRADE CONTOUR
- PROPERTY LINE
- PROPOSED ACCESS ROAD LOCATION

NOTE:

1. BASE MAP OBTAINED FROM SITE DESIGN, INC. AND THE PICKENS COUNTY GIS DEPARTMENT.
2. LAND DISTURBING ACTIVITIES SHALL BE CONDUCTED IN ACCORDANCE WITH PICKENS COUNTY PLANNING COMMISSION'S MAY 10, 2006 APPROVAL LETTER. CONDITIONS OF APPROVAL INCLUDE: DREDGED MATERIALS ARE TO BE PLACED ON BALL PROPERTY AND NONE ARE TO BE SOLD OR PLACED ELSEWHERE, AND DEED RESTRICTIONS MUST BE PLACED UPON BALL PROPERTY.

NATIONAL WETLAND INVENTORY COWARDIN CLASSIFICATION				
AREA	SYSTEM	SUBSYSTEM	CLASS	MODIFIER
L1UBHh	LACUSTRINE	LIMNETIC	UNCONSOLIDATED BOTTOM	PERMANENTLY FLOODED/IMPOUNDED
L2USCh	LACUSTRINE	LITTORAL	UNCONSOLIDATED SHORE	SEASONALLY FLOODED/IMPOUNDED
PUBHh	PALUSTRINE		UNCONSOLIDATED BOTTOM	PERMANENTLY FLOODED/IMPOUNDED
R3UBH	RIVERINE	UPPER PERENNIAL	UNCONSOLIDATED BOTTOM	PERMANENTLY FLOODED

DRAFT

XREFS: 01019B01 01019X00 01019X02

300' 0 300' 600'
1"=300'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

THIS DRAWING IS THE PROPERTY OF THE ARCADIS ENTITY IDENTIFIED IN THE TITLE BLOCK AND MAY NOT BE REPRODUCED OR ALTERED IN WHOLE OR IN PART WITHOUT THE EXPRESS WRITTEN PERMISSION OF SAME.

Professional Engineer's Name: JOHN PAUL DOODY
Professional Engineer's No.: 20608
State: SC | Date Signed: | Project Mgr.: LSK
Designed by: | Drawn by: GMB | Checked by:

ARCADIS
ARCADIS U.S., INC.

SCHLUMBERGER TECHNOLOGY CORPORATION • 255 SCHLUMBERGER DRIVE • SUGARLAND, TEXAS • TEL. 281.285.8298
SANGAMO/WESTON/TWELVEMILE CREEK/LAKE HARTWELL PCB CONTAMINATION SUPERFUND SITE • PICKENS COUNTY, SOUTH CAROLINA
TWELVEMILE CREEK RESTORATION PROJECT

SITE PLAN

REVISED AREA OF DISTURBANCE

GENERAL

ARCADIS Project No. MT001019.0001.00010
Date AUGUST 2009
ARCADIS
P.O. BOX 66
6723 TOWPATH ROAD
SYRACUSE, NEW YORK
TEL. 315.446.9120

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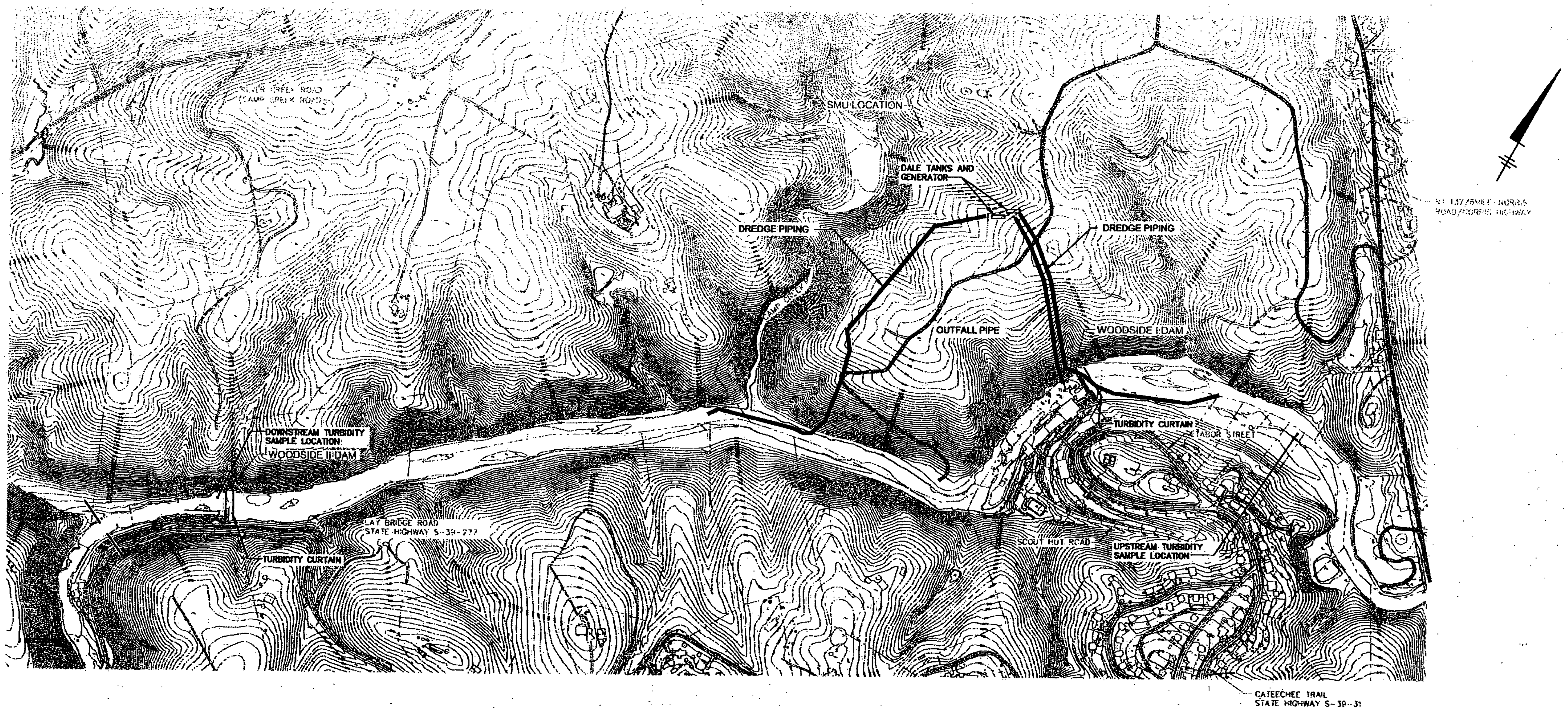

LEGEND:

EXISTING GRADE CONTOUR

PROPERTY LINE

NOTES:

1. BASE MAP OBTAINED FROM SITE DESIGN, INC. AND THE PICKENS COUNTY GIS DEPARTMENT.

0 300' 600'
GRAPHIC SCALE

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER
JOHN P. DOODY

SCHLUMBERGER TECHNOLOGY CORPORATION
PICKENS COUNTY, SOUTH CAROLINA
TWELVEMILE CREEK RESTORATION SWPPP

SWPPP FOR WORK ADJACENT TO TWELVEMILE CREEK

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FIGURE
3